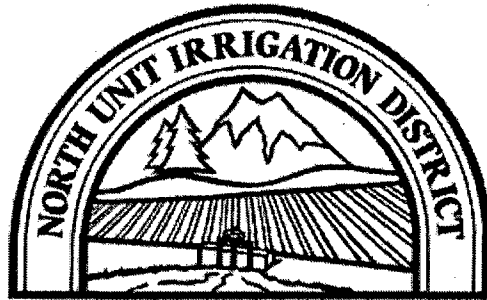


**North Unit Irrigation District  
Lateral 58-11 Piping Project**

**Reclamation WaterSMART Water and Energy  
Efficiency Grant Proposal**

**January 17, 2012**



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## **1. Technical Proposal**

### **1.1. Executive Summary**

Date: January 17, 2012  
Applicant Name: North Unit Irrigation District  
City/County/State: Madras, Jefferson County, Oregon

Describe overarching initiative.  
List major benefits of this Phase

- Water saved
- Energy saved and generated
- Instream flow restoration

North Unit Irrigation District (NUID) proposes to Pipe approximately five miles of its Lateral 58-11 and conserve up to 673 acre-feet (AF) of water from the Deschutes River. This project will be completed in three phases. This application is to pipe approximately two miles of canal and conserve 673 acre feet. The saved water will be used to irrigate lands currently supported by water that is pumped from the Crooked River. The Crooked River water rights displaced by the new water resulting from the piping project will be retired to support water quality and fish habitat improvements in the Crooked River.

The project will provide benefits within all four Task Areas defined by the Bureau of Reclamation (Reclamation) in Funding Opportunity Announcement No. R11SF80303. The project will enhance irrigation conveyance efficiencies within NUID and generate up to 673 AF of new water supply for farmers in NUID (Task Area A), improve conditions for ESA listed Mid-Columbia steelhead trout in the lower Crooked River (Task Area B), conserve an estimated average 158,155 (see Exhibit A) kilowatt hours of electricity annually in perpetuity, and potentially create an estimated 494,148 kilowatt hours of renewable energy (Task Area C), utilize a water banking/marketing to facilitate the reallocation of water from an agricultural water use to an environmental water use and the allocation of the conserved water to existing agricultural uses (Task Area D). When complete, the project will produce up to 673 AF of new water supply to help meet existing agricultural and environmental water supply needs. The project will be constructed by May 2014 and the water transfers will be complete by 2016.

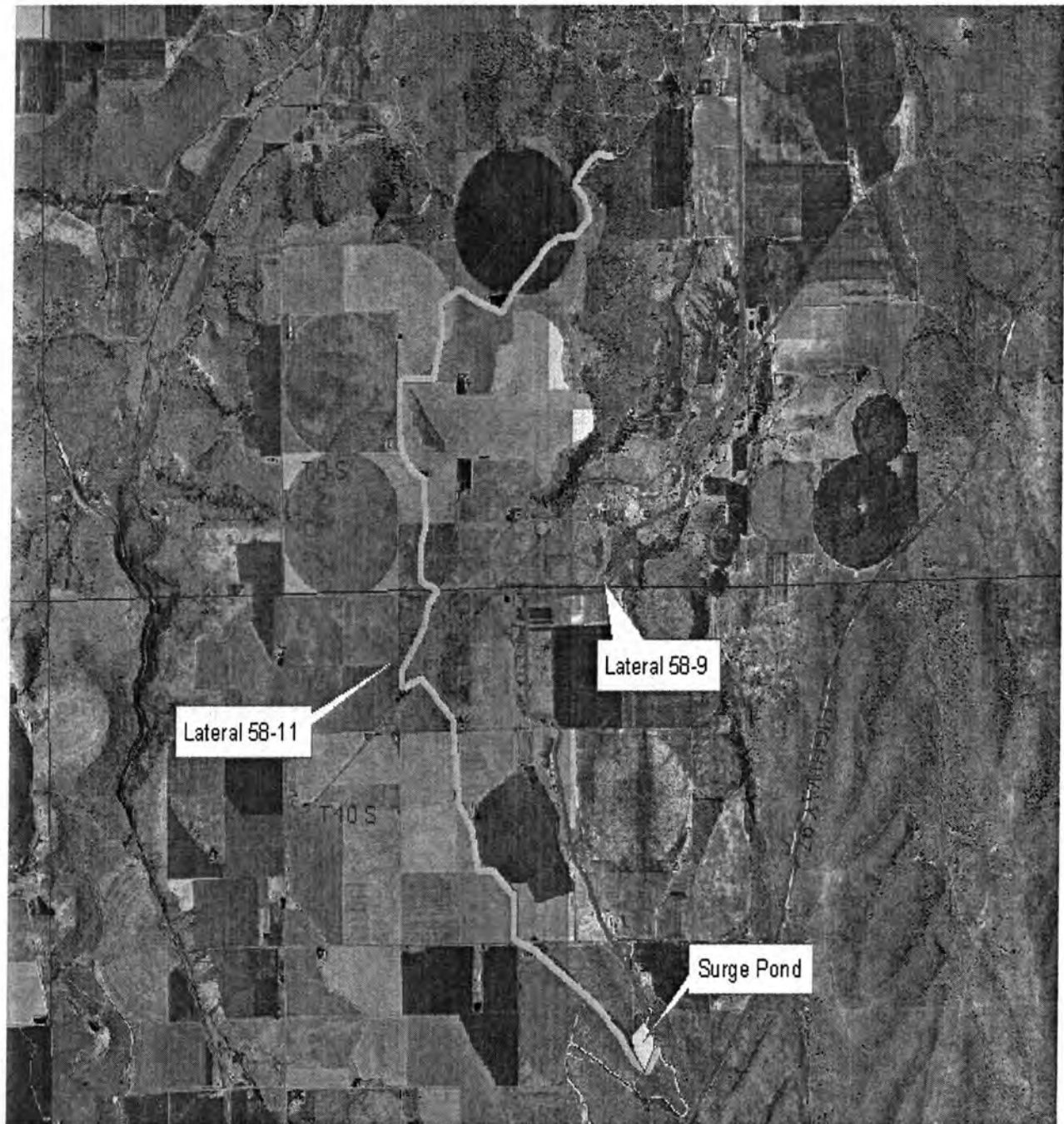
This project is part of a larger North Unit Water Supply Initiative. The ultimate goal of the North Unit Water Supply Initiative is to replace 9,000 acres of Crooked River primary water rights on NUID lands with Deschutes River water rights generated through conserved water projects and to transfer the Crooked River water rights permanently instream in the Crooked River. NUID benefits by eliminating its need to pump water from the Crooked River. Increased flows in the Crooked River benefit the reintroduction of federally-listed mid-Columbia summer steelhead. The whole initiative will restore up to 220 cfs to the Crooked River and save an average of 4,887,640 kwh of energy annually.

Phase I of the North Unit Water Supply Initiative project is being implemented in 2011-12, with support from a Reclamation Watersmart grant. Phase I lines five miles of NUID's main canal,

and utilizes a water banking agreement to transfer 7,880 acre-feet of conserved Deschutes water to NUID Crooked River lands, transferring the corresponding Crooked River water rights instream. This project will save NUID approximately 158,155 kilowatt hours of electricity, save an estimated \$64,290 to \$93,564 annually, and restore up to 20 cfs to the lower Crooked River to benefit Federally-listed Mid-Columbia steelhead. NUID is also supporting a proposed Phase II project that utilizes a water banking process, but generates the conserved water through a piping project in Central Oregon Irrigation District. This elevates the innovation of water management in the Deschutes Basin, allowing districts to cooperate to leverage the most cost-effective projects to meet the goals of the Initiative. This inter-district cooperation also allows districts with different needs to meet their particular goals. For example, Central Oregon Irrigation District does not need additional water, but benefits from the operational efficiencies of canal piping. NUID benefits from putting the available conserved water on agricultural lands from which Crooked River rights can be transferred instream, saving energy costs and improving flows in the Crooked River. This approach allows NUID and partners to implement the most cost-effective projects to reach its ultimate goal of eliminating its need to pump Crooked River primary rights, and leverages conservation opportunities in the Deschutes watershed to benefit reintroduced anadromous fish in the Crooked River.



Figure 2. NUID Lateral 58-11 – Project Map



### **1.2.2. Deschutes Basin Water Management**

Within the Deschutes Basin, eight irrigation districts serve the water needs of their patrons by diverting water from the Deschutes River and its tributaries. The districts are local governments formed under Oregon Revised Statutes Chapter 545. They are also political subdivisions of the state of Oregon and municipal corporations. The districts deliver water to over 150,000 acres of land through approximately 627 miles of canals and laterals.

The porous, volcanic soils of the Deschutes Basin cause a significant portion of the water that flows through irrigation canals to seep into the ground. Approximately 50% of the water that is diverted from the river is lost due to seepage from canals and cannot be used for irrigation. This means that the irrigation districts who manage these canals must divert twice the amount of water that they need to serve their patrons' needs for irrigation water.

Past water conservation efforts have reduced the amount of water diverted from the river; however, the river is still over-appropriated, meaning that more water is authorized to be diverted from the river than actually exists in the river.

### **1.2.3. North Unit Irrigation District Infrastructure, Water Supply and Water Rights**

North Unit Irrigation District (NUID) utilizes water from the Crooked and Deschutes Rivers to serve approximately 59,000 acres of productive farmland. NUID lands are predominately in Jefferson County. Water is delivered through a network consisting of 65 miles of canals and 235 miles of laterals. Of the total area served, approximately 50,000 acres receive their primary supply from the Deschutes River and the remaining 9,000 acres receive deliveries from the Crooked River. A total of 850 landowners receive water from NUID. Principal crops produced by NUID farmers include irrigated pasture, hay, alfalfa, wheat, and grass seed. North Unit Irrigation District's 2003 Water Conservation Plan documents that on an average year, with an estimated 65% district-wide on-farm efficiency, supply averages 121,492 AF for a demand of 151,000 AF, signaling that additional irrigation water supply of approximately 29,400 AF would be necessary to meet the on-farm crop use for the total acres (Net Irrigation Requirement) (NUID, 2003).

#### **Deschutes River Water Supply**

Water from the Deschutes River is supplied by a diversion at river mile 160 that diverts water into the Main Canal. The canal was built in the mid 1940s by Reclamation and transferred to NUID to manage and operate shortly thereafter. The Main Canal is approximately 65 miles long, starting at the diversion dam and heading generally in a northerly direction before terminating just north of the town of Madras. The canal was built for a maximum capacity of 1000 cubic feet per second (cfs). Because water diverted from the Deschutes River can be delivered by gravity, the district does not incur any pumping costs associated with these water rights.

North Unit Irrigation District's principal water right from the Deschutes River is described in Certificate 72279. It certifies the right to divert water from the Deschutes River, Wickiup Reservoir and Haystack Reservoir to irrigate 49,916 acres, with a priority date of February 28, 1913. The district is the junior water right holder on the Deschutes River and as such, relies more heavily on stored water than other irrigation districts in the basin. Based on historic



averages of water diverted from the Deschutes River at Bend, roughly 30% of the water is from the district's natural flow water right and 70% is from stored water originating in Wickiup Reservoir. Wickiup Reservoir has a maximum capacity of 200,000 AF and reaches full fill in approximately seven out of ten years. In years that the reservoir does not fill, the district must employ a number of drought management strategies including additional supplemental pumping from the Crooked River, land fallowing, and deficit irrigation practices.

#### **Crooked River Water Supply**

In 1968, NUID constructed a pumping plant adjacent to and at the point where the Main Canal crosses the Crooked River. The primary purpose of the plant is to furnish a supplemental water supply, when needed, by pumping from the Crooked River and discharging into the Main Canal. However, the plant also provides a primary water supply to approximately 9,000 acres of land, which are spread throughout the district. The plant consists of nine vertical shaft pumps with a total capacity of 200 cubic feet per second at a total dynamic head of 150 feet. Each pump is powered by a 450-horsepower motor that pumps the water into a 60-inch steel-pipe discharge line 220 feet long. The power for the pumping plant is supplied under contract by the Central Electric Cooperative.

NUID uses water from the Crooked River under four water right certificates (cert. 72281, 72282, 72283, and 72284). Pumping water from the Crooked River canyon costs approximately \$15 per acre foot in electricity charges due to the change in elevation between river and canal. Pumping costs can exceed \$300,000 during a normal irrigation season and rates are expected to increase significantly in the future. Pumping costs are covered by assessing fees to farmers based on the number of acres of water rights they own.

#### **1.2.4. North Unit Irrigation District Energy Utilization**

North Unit's main energy usage is associated with the Crooked River Pumping Plant described above. It sources energy from Central Electric Cooperative and averages 1,220,163 kilowatt hours per year. The district is highly invested in reducing its pumping demand from the Crooked River, and is also actively assessing small hydropower opportunities on its canals. The district completed a feasibility study of five potential hydropower sites in 2009 and is in the process of conducting feasibility on an additional six sites. The district intends to move forwards with preliminary design of at least one hydropower project.

#### **1.2.5. North Unit Bureau of Reclamation Partnership**

North Unit Irrigation District has a long-standing relationship with the Reclamation as part of the Deschutes Project. The Deschutes Project includes Wickiup Reservoir, Haystack Dam and Reservoir, the North Unit Main Canal, and associated delivery facilities. The Deschutes project was authorized by a finding of feasibility by the Secretary of the Interior dated September 24, 1937, approved by the President on November 1, 1937, pursuant to section 4 of the Act of June 25, 1910 (36 Stat. 836) and subsection B of section 4 of the Act of December 5, 1924 (43 Stat. 702). Construction of Haystack Dam and equalizing reservoir was authorized by act of the Congress on August 10, 1954, (68 Stat. 679, Public Law 83-573). In 2007, a congressional bill and contract modification, initiated and funded by NUID, was passed that authorized NUID to participate in conserved water projects. Previously NUID could not participate in conserved water projects as a result of the conditions of their contract with the US Bureau Reclamation.

The District has participated in numerous water conservation projects with Reclamation's financial support. Recent projects are summarized below:

**Completed**

**1995** – Lateral 52, installation of 12,500 feet of pipe to enclose an open canal.

Reclamation Funding: \$126,000

**1998** – Lateral 51-4, demonstration high head pressure pipeline system, installation of 25,000 feet of pipe to enclose an open canal.

Reclamation Funding: \$105,000

**2002** – Lateral 58-1, pipe approximately 5 miles of open canal to save water and reduce soil erosion by decreasing canal seepage.

Reclamation Funding: \$107,188

**2003** – North Unit Small Pipelines 2003 – piping of various short sections of canals in the distribution system to prevent erosive destruction of the canal banks by livestock and to save water. The project included installation of three pipelines for a total of 6,291 feet.

Reclamation Funding: \$38,000

**2004** – Lateral 58, this project included 6,600 feet of pipe and abandon a section of lateral that passes through an industrial park. This piping project saved water and prevented soil erosion by decreasing canal seepage. Abandoning the section through the industrial park will kept runoff from parking lots and roofs from entering the irrigation system.

Reclamation Funding: \$66,972

**2004** – Lateral 51-1, piping approximately 3,500 feet of the distribution system to prevent seepage losses and soil erosion.

Reclamation Funding: \$11,470

**2005** – Automation and Telemetry Financial and Technical Assistance to install telemetry at Haystack Reservoir, 58 lateral turnout, 37-6 lateral and 58-11 lateral to conserve water and enhance water management through automation.

Reclamation Funding: \$24,100

**2005** – Water 2025 GIS and Aerial Imagery Consortium: Using Technology, Best Practices and Information System Management to Support Conservation Program Development and Implementation.

Reclamation Funding: \$25,000

**2006** – Lateral 58-3, pipe 1,800 feet to conserve water and enhance on farm irrigation efficiency.

Reclamation Funding: \$20,017

**2007 – Piping Laterals 53, 58-13 and 63-1.** Upgrade 3 laterals from open ditch or leaking pipe to plastic pipe to conserve water, increase water use efficiency and enhance water management.

Reclamation Funding: \$55,410

**2007 – Water 2025 Challenge Grant, Telemetry & Action Plan.** Partner with 5 other irrigation districts in Central Oregon to install flow measurement telemetry stations at 18 strategic locations across the 5 districts to measure the benefits of water conservation. Two sites were installed on the district.

Reclamation Funding: \$8,818

**2007 – Water 2025 Challenge Cost Share Program, Lateral 58-9 Pipeline Phase I –** improve Lateral 58-9 by converting one half mile of open earth ditch to two parallel pipes to conserve water and thereby increase available water supplies associated with Reclamation's Deschutes River Project.

Reclamation Funding: \$237,002

**2008 – WCFSP Pipelines 41-6 Lateral and 43-7-1 Lateral (1425-08-FG-1L-1350)** Convert sections of two earthen ditches to pipe to conserve water by reducing seepage and evaporation losses.

Reclamation Funding: \$38,906

**2009 – WCFSP Ramp Flume – Lateral 58 (09FG1U1421)** Install a ramp flume on Lateral 58 to for more accurate measure of water at the head end of the lateral to conserve an estimated 900 AF of water per year. (Revised to installation of an acoustic Doppler)

Reclamation Funding: \$16,270

#### **In Progress**

**2009 – WCFSP Lateral 58-9 Piping Phase II (09FG1U1446)** Install 22,000 feet of pipe to provide improved water management; eliminate soil erosion; pressurize a portion of the water delivery system and improve water quality.

Reclamation Funding: \$318,663

**2010 – Modernization of the Bend Diversion (R10AP1C006)** NUID will replace and/or install at the headgate, river site, flow monitoring station and the canal site flow monitoring station SCADA Programmable Logic Controllers, river/gate position sensors, and cellular modem to communicate data.

Reclamation Funding: \$31,016

**2010 – Haystack Flow Measurement (R10AP1C052) –** Install a Horizontal Acoustic Doppler Current Profiler within the district's easement near the base of Haystack Dam just downstream where the bypass chute and Haystack discharge come together.

Reclamation Funding: \$10,899

**2011 – 58-9 Surge Pond R11AP1C008–** Construct a surge pond at the confluence of Lateral 58-9 and Lateral 58-11 to improve water management capacity. The surge pond is

designed to hold 25 to 30 acre feet of water and will be utilized to catch irrigation water surges in the system and utilize the water for irrigation rather than allowing it to flow off the irrigation district and carry excess sediment into the creeks, degrading critical fish habitat.

**2011-12 - North Unit Irrigation District Energy and Conservation Initiative**  
(R11SF80303) Line approximately five miles of its Main Canal and conserve up to 7,880 acre-feet (AF) of water from the Deschutes River. The saved water will be used to irrigate lands currently supported by water that is pumped from the Crooked River. The Crooked River water rights displaced by the new water resulting from the lining project will be retired to support water quality and fish habitat improvements in the Crooked River. Reclamation Funding: \$1,000,000

#### **1.2.6. North Unit Irrigation District Infrastructure, Water Supply and Water Rights**

North Unit Irrigation District (NUID) utilizes water from the Crooked and Deschutes Rivers to serve approximately 59,000 acres of productive farmland. NUID lands are predominately in Jefferson County. Water is delivered through a network consisting of 65 miles of canals and 235 miles of laterals. Of the total area served, approximately 50,000 acres receive their primary supply from the Deschutes River and the remaining 9,000 acres receive deliveries from the Crooked River. A total of 850 landowners receive water from NUID. Principal crops produced by NUID farmers include irrigated pasture, hay, alfalfa, wheat, and grass seed. North Unit Irrigation District's 2003 Water Conservation Plan documents that on an average year, with an estimated 65% district-wide on-farm efficiency, supply averages 121,492 AF for a demand of 151,000 AF, signaling that additional irrigation water supply of approximately 29,400 AF would be necessary to meet the on-farm crop use for the total acres (Net Irrigation Requirement) (NUID, 2003).

#### **1.2.7. North Unit Irrigation District Energy Utilization**

##### **On Farm Use**

Sustaining agriculture in the basin has become an issue due to the high cost of energy compared to the income from farming and economic pressures to maintain viable operation for small farms. The Lateral 58-11 piping project will provide farms within the project area pressurized irrigation systems thereby minimizing irrigation pump use or eliminating irrigation pumping completely as a result of the 58-11 piping project.

##### **Potential Hydroelectric Development**

NUID commissioned a hydro feasibility study in August 2009 that looked at several locations within the district including a piped Lateral 58-11. The feasibility report concluded that without grant participation, the project does not appear financially viable. However, given moderate cost control during design and implementation of the project, the project yields a positive benefit versus cost ratio and an acceptable simple payback period. The district will continue to seek out funding opportunities for potential hydroelectric development and will be considered in future phases of the Lateral 58-11 piping project. Feasibility Report attached. (see Exhibit B)

### **Crooked River Pumping Plant**

In 1968, NUID constructed a pumping plant adjacent to and at the point where the Main Canal crosses the Crooked River. The primary purpose of the plant is to furnish a supplemental water supply, when needed, by pumping from the Crooked River and discharging into the Main Canal. However, the plant also provides a primary water supply to approximately 9,000 acres of land, which are spread throughout the district. The plant consists of nine vertical shaft pumps with a total capacity of 200 cubic feet per second at a total dynamic head of 150 feet. Each pump is powered by a 450-horsepower motor that pumps the water into a 60-inch steel-pipe discharge line 220 feet long. The power for the pumping plant is supplied under contract by the Central Electric Cooperative.

The current average kwh pumped annually at the Crooked River pumping facility is 4,887,640 based on a 10 year average. Pumping water from the Crooked River canyon costs approximately \$15.33 per acre foot in electricity charges due to the change in elevation between river and canal. Pumping costs can exceed \$300,000 during a normal irrigation season and rates are expected to increase significantly in the future. Pumping costs are covered by assessing fees to district patrons and customers.

## **1.3. Technical Project Description**

### **1.3.1 Project Background**

North Unit Irrigation District (NUID) proposes to pipe approximately two miles of its Lateral 58-11 and conserve up to 673 acre-feet (AF) of water from the Deschutes River. The saved water will be used to irrigate lands currently supported by water that is pumped from the Crooked River. The Crooked River water rights displaced by the new water resulting from the piping project will be retired to support water quality and fish habitat improvements in the Crooked River below NUID's point of diversion at river mile 28.

The district, a part of Reclamation's Deschutes Project, supplies water to 59,000 acres of cropland near Madras, Oregon. Most of the district's water supply is diverted by gravity from the Deschutes River at Bend into the district's Main Canal. The Main Canal conveys water from the Bend diversion to farming areas north of Madras, over a total distance of about 65 miles. Water for approximately 9,000 acres of cropland is pumped from the Crooked River.

The 58-11 Lateral was constructed by excavating into volcanic lava flows and ash deposits. The volcanic materials are fractured and broken, resulting in high seepage losses (Reclamation 1997). The district has made significant investments in the past to improve the conveyance efficiency of its delivery systems (see Section 1.2.5 above).

North Unit Irrigation District proposes to use a water exchange program to apply water conserved through its piping project to lands that NUID currently irrigates with water from the Crooked River. By transferring saved water from the Deschutes River to these lands, NUID can retire a similar volume of water from the Crooked River, thereby increasing instream flows, enhancing water quality and improving habitat for native fish like redband trout, mid-Columbia steelhead and Chinook salmon. North Unit Irrigation District will utilize the exchange to facilitate: (1) the reallocation of water from agricultural uses to instream uses, and (2) the allocation of saved water to existing agricultural uses.

### **1.3.2 Phase I: NUID Lateral 58-11 Piping Project**

NUID proposes to pipe an open earth lateral off of the NUID 58 Lateral, known as the Lateral 58-11. The 58-11 Lateral is a transferred works facility operated and maintained by NUID. The NUID diversion is located near Bend on the Deschutes River (approximately RM 170) at SW 1/4, NE 1/4, Sec 13, T.18 S., R.11 E., W.M. Water is diverted through a headgate structure and travels through the lined and open earth North Unit Main Canal before reaching the diversion for the 58 Lateral. Phase I of the proposed piping project is approximately 11,485 in length.

Approximately half of all water diverted into the 58-11 Lateral is lost to seepage through the sides and bottom of the canal. By replacing open earthen canals with enclosed pipelines, water seepage can be reduced to virtually zero. NUID has worked with NRCS, USDA, Elwin Ross (PE) and Black Rock Consulting (BRC) to quantify the amount of water that will be saved by analyzing pre-project water loss data. Measurements have shown that 11,485 linear feet of piping will result in a peak total of 1.89 cfs.

Engineering design has been completed by Black Rock Consulting (BRC) for the Lateral 58-11 piping project. The project will install 11,485 feet of 48" and 42" diameter DR 32 HDPE pipe which will be buried and backfilled. It includes all necessary fittings, valves, air and vac assemblies, thrust blocks and post project completion seeding.

BRC has conducted similar design and construction oversight work on other major irrigation projects in NUID such as the NUID 58-9 Lateral piping project as well as projects throughout Central Oregon including the Central Oregon ID Pilot Butte/Juniper Ridge piping and the Swalley Main Canal piping projects. BRC is a well established, experienced and reputable engineering firm. In addition to the project designs, biological assessments and cultural resource surveys of the canal have already been conducted and are ready to submit to satisfy the federal environmental and historical compliance.

### **1.3.3 Project Summary**

In summary, this project proposes to conserve 673 acre-feet of water of Deschutes River water in NUID, transfer that conserved water to existing NUID lands that receive Crooked River water and transfer the Crooked River rights permanently instream in the Crooked River. It will restore 1.89 cfs to a critically-dewatered reach of the Crooked River, will save 158,155 kwh of energy by reducing the amount of water required to pump out of the Crooked River, This project elevates the innovation and collaboration of water management in the Deschutes Basin and opens the door to additional inter-district projects that will ultimately restore up to 220 cfs to the Crooked River and eliminate NUID's need to pump primary water rights from the Crooked River.

## **1.4. Evaluation Criteria**

### **1.4.1. Evaluation Criterion A: Water Conservation**

#### **Subcriterion No. 1—Water Conservation**

#### ***Subcriterion No. 1(a)—Quantifiable Water Savings***

The project will conserve 673 AF on an annual basis. The water that will be conserved currently seeps into the ground through the bottom and sides and flows off the end of the open delivery system of NUID's 58-11 Lateral. Conserved water will be transferred to meet existing irrigation and instream needs. NUID will transfer a corresponding volume of water permanently instream to restore flows in the Crooked River.

Approximately half of all water diverted into the 58-11 Lateral canal is lost to seepage through the sides and bottom of the canal. By replacing open earthen canals with enclosed pipelines, water seepage can be reduced to virtually zero. Losses in the canal laterals have been documented in the following studies:

Upper Deschutes River Basin Water Conservation Study. 1997. Bureau of Reclamation and Oregon Water Resources Department.

Lateral 58-11 Hydraulic Analysis. Black Rock Consulting 2009

NUID for many years has measured seepage loss throughout the district as part of its water loss measurement program to assist in identifying prioritized seepage loss areas within the district. During the irrigation season daily measurements are taken throughout the district. Several locations along the Main Canal are measured with continuous recording gauges. Access to the existing current flow at the end of the Main Canal is available by anyone in district operations having a cell phone. Several locations on the Main Canal are also measured to determine high seepage loss areas, using ramp type flumes. Many of the sub-main canals have measuring devices at the turnouts from the main canal, i.e. standard trapezoidal weirs. Each lateral is measured using standard trapezoidal weirs. The points of delivery to waterusers are all measured using standard trapezoidal weirs (Yakima Weir), cipoletti weirs, submerged orifices, or flow meters inside conduits. The district continually evaluates prospective locations for additional flow measurement that will improve operation and management. Standard devices used include stream rating sections, ramp flumes, trapezoidal weirs, cipoletti weirs, submerged orifices, and flow meters. Measuring (SonTek Doppler technology) and telemetry systems have been added throughout the delivery system and most recently at Haystack Reservoir and Lateral 58. A flow meter policy that will have a standard uniformity has been established for water users that have metered deliveries. The policy regulates how water through flow meters will be delivered and how volumes will be calculated.

### **Average Annual Water Supply**

The total annual average volume of water supplied to the NUID over the periods of record 2000, 2002 to 2007, and 2009 is 162,000 AF.

### **Proposed Use of Conserved Water Supply**

The water conserved through this project will be transferred to irrigated lands within NUID and a corresponding volume of Crooked River water rights will be transferred instream. NUID currently irrigates these lands with water from the Crooked River, a tributary to the Deschutes River. In return for being provided new gravity flow water from the Deschutes River, NUID will retire a corresponding volume of their Crooked River water right to help satisfy instream flow needs in the lower Crooked River. This arrangement will provide cost-relief to NUID who

currently have to pay to pump water from the lower Crooked River by providing them with new water rights that are delivered by gravity from the Deschutes River.

The District has established a lottery system to distribute the conserved water within the irrigation district. The lottery will give Crooked River water right holders first priority for new Deschutes River water rights. Approximately 9,000 acres are irrigated from the Crooked River. These acres are dispersed geographically throughout NUID.

The approach described above was piloted in Phase I of the North Unit Water Supply Initiative, which generated conserved water through lining 5 miles of NUID's Main Canal. Reviews of Oregon's Conserved Water Statute and numerous conversations with staff at the Oregon Water Resources Department show that the exchange process is within the parameters of the Conserved Water Statute. Implementing this project will demonstrate increased flexibility in the conserved water program making similar exchange projects less cumbersome and complicated.

***Subcriterion No. 1(b)—Improved Water Management:***

This project will result in the more efficient use of 673 AF of NUID's water supply. Instead of allowing the water to seep into the ground as canal transmission losses, the water will instead be conserved and applied to NUID lands that currently rely on pumped water from the Crooked River for their water supply. By implementing this conservation measure, NUID will improve the productivity of its existing water supply and reduce the maintenance cost of delivering water to its members through the 58-11 Lateral. Piping the lateral also reduces the transport time of water to patrons, allowing the district to respond more quickly to increases or decreases in demand, reducing waste.

**Subcriterion No. 2—Percentage of Total Supply:**

Conserving 673 acre-feet on the 58-11 Lateral represents less than 1 percent of NUID's average total supply.

**Subcriterion No. 3—Reasonableness of Costs:**

The estimated project cost is \$1,900,000 to pipe 11,485 feet of the 58-11 Lateral. Piping the 58-11 Lateral will save a calculated volume of 673 AF of irrigation water annually from seepage losses. These seepage losses combine with the potential for electrical power savings at the Crooked River Pumps equals \$10,317 annually at 2011 power rates.

Reasonable costs equal a reasonableness of \$53.49 based on a 50 year improved life.

**1.4.2. Evaluation Criterion B: Energy-Water Nexus**

**Subcriterion No. 1— Implementing Renewable Energy Projects Related to Water Management and Delivery**

The district has conducted a hydropower feasibility study at a location near the terminus of the proposed piping project. Initial review of the elevation drop and average flow rates in the canal at this location suggests (based on averaging data) that approximately 494,148 kwh of power could be generated at the site by adding a plant to the project pipeline. The addition of a hydropower facility will be considered in future phases of the Lateral 58-11 project.



### Subcriterion No. 2—Increasing Energy Efficiency in Water Management

In 1968, NUID constructed a pumping plant adjacent to and at the point where the Main Canal crosses the Crooked River. The primary purpose of the plant is to furnish a supplemental water supply, when needed, by pumping from the Crooked River and discharging into the Main Canal. However, the plant also provides a primary water supply to approximately 9,000 acres of land, which are spread throughout the district. The plant consists of nine vertical shaft pumps with a total capacity of 200 cubic feet per second at a total dynamic head of 150 feet. Each pump is powered by a 450-horsepower motor that pumps the water into a 60-inch steel-pipe discharge line 220 feet long. The power for the pumping plant is supplied under contract by the Central Electric Cooperative.

The current average kwh pumped annually at the Crooked River pumping facility is 4,887,640 based on a 10 year average. Pumping water from the Crooked River canyon costs approximately \$15.33 per acre foot in electricity charges due to the change in elevation between river and canal. Pumping costs can exceed \$300,000 during a normal irrigation season and rates are expected to increase significantly in the future. Pumping costs are covered by assessing fees to district patrons and customers.

The proposed project will reduce the amount of water that NUID pumps from the Crooked River by 673 AF. On average, this reduction in pumping will conserve approximately 158,155 kilowatt hours of electricity. Potential cost savings have been estimated at \$10,095 annually at 2011 power rates. This reduction will be additive to other projects that help reduce the pumping demand at the Crooked River as part of the larger North Unit Water Supply Initiative.

Anticipated beneficiaries, other than the applicant, of the renewable energy system include production ag lands irrigating approximately 3,000 acres. The Lateral 58-11 project will provide those ag producers with a pressurized delivery system. The ag producer will benefit by minimized or eliminated need to run irrigation pumps, less O&M related to irrigation pumping and there will be less demand on the power grid. All of these landowners irrigate using pumps receiving 2 - 4 Ac Ft of water per acre over 3,000 acres for a total of 21,000 Acre Feet times the variables for cost depending on the circumstances for their property. If electricity is 5 cents/kwhR to pump 21,000 Ac Ft of water at \$10.23 per acre foot the cost would be \$122,760 per season.

Pumping Costs					
Cents per KwHr					
3	4	5	6	8	10
Electric Power Costs					
Pumping 1 AF of water against 1 ft of lift, at 1000 gpm flow rate					
\$0.041	\$0.055	\$0.068	\$0.082	\$0.109	\$0.136
Pumping 1 AF of water against 100 ft of lift, at 1000 gpm flow rate					
\$4.09	\$5.46	\$6.82	\$8.18	\$10.91	\$13.64
Pumping 1 AF of water against 150 ft (65 psi) of lift, at 1000 gpm flow rate					
\$6.14	\$8.19	\$10.23	\$12.27	\$16.36	\$20.46
Pumping 1 AF of water against 200 ft					

of lift, at 1000 gpm flow rate	\$8.18	\$10.91	\$13.64	\$16.37	\$21.83	\$27.28
Pumping 1 AF of water against 300 ft of lift, at 1000 gpm flow rate	\$12.28	\$16.37	\$20.46	\$24.55	\$32.74	\$40.92
Pumping 1 AF of water against 400 ft of lift, at 1000 gpm flow rate	\$16.37	\$21.83	\$27.28	\$32.74	\$43.65	\$54.56
<b>NOTES:</b>						
<b>Wire to water efficiency assumed at 75%</b>						
<b>Pumping rate assumed at 1000 gpm</b>						
by Elwin Ross, 3-10-05						
(Data by Elwin Ross, PE)						

#### 1.4.3. Evaluation Criterion C: Benefits to Endangered Species

This project will improve conditions for Endangered Species Act listed Middle Columbia Steelhead in the Crooked River, a tributary to Oregon's Deschutes River. Cascades Eastern Slope Tributaries is a Major Population Group (MPG) of Middle Columbia Steelhead. Three Distinct Population Segments (DPS) of this MPG exist in Deschutes Basin: 1) Deschutes River West Side, 2) Deschutes River East Side, and 3) Crooked River (extinct).

Crooked River steelhead became extinct following the development of Pelton Round Butte hydroelectric facility. The facility blocked downstream anadromous fish passage in the Deschutes River at its confluence with the Metolius and Crooked Rivers. As part of a FERC relicensing agreement completed in 2005, facilities co-managers Portland General Electric and the Confederated Tribes of the Warm Springs Reservation agreed to provide passage at and reintroduce anadromous fish above the Pelton Round Butte facility. They first reintroduced juvenile steelhead to the Crooked River in 2008 and will continue to release juvenile fish above the Pelton Round Butte project until they meet standards set out in the relicensing agreement.

Crooked River steelhead are protected under the Endangered Species Act. Currently, fisheries managers consider re-introduced Crooked River steelhead to be a nonessential population not necessary to the recovery and/or delisting of the species. When reintroduction is complete above the Pelton Round Butte project, the Crooked River population will extend the range of the species and contribute to the population numbers included in the Cascades Eastern Slope Tributaries MPG and help to meet recovery goals for the species. Fisheries managers expect adult steelhead will return to the lower Crooked River in 2012.

A research, monitoring and evaluation (RM&E) plan covers the Oregon portion of the Middle Columbia Steelhead DPS. It describes the RM&E recommended for assessing the status and trends in population viability and for evaluating the success of management actions implemented to recover these steelhead populations. This plan is based in part on principles and concepts laid out in the NMFS guidance document *Adaptive Management for ESA-Listed Salmon and Steelhead Recovery: Decision Framework and Monitoring Guidance (May 1, 2007)*. Deschutes River Eastside and Deschutes River Westside populations are routinely monitored for abundance and spatial distribution of spawning adults (redd counts from spawning ground surveys) and the

effect of genetic introgression of hatchery strays on wild populations. The extirpated Crooked River population is not addressed in the RM&E plan; however, monitoring meant to gauge the success of the reintroduction effort is ongoing. This monitoring effort is described in Section 9 of *Recovery Strategies and Management Actions Oregon Mid-C Steelhead Recovery Plan* and is administered primarily by PGE.

The Crooked River is currently not listed as Critical Habitat for Middle Columbia Steelhead. However, if the reintroduction effort is successful in the Crooked River then designation of critical habitat will likely occur.

The Mid-Columbia Steelhead Distinct Population Segment Recovery Plan (NMFS 2009) lists degraded water quality in the Crooked River from RM 17 to RM 51 as a primary factor limiting steelhead recovery. This portion of the Crooked River is listed by Oregon DEQ as a 303(d) impaired stream for exceeding temperature, dissolved gas, and pH standards. NUID's pumps in this reach have the ability to divert nearly all of the flows from the Crooked River, contributing to elevated stream temperatures, turbidity, and low dissolved oxygen during the irrigation season. Water quality monitoring of the Lower Crooked in is ongoing.

A key strategy identified in the Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment (Carmichael et al 2010) for steelhead in the Crooked River is to restore a more natural hydrograph and provide sufficient flow during critical periods. Actions associated with this strategy include implementing agricultural water conservation measures, improving irrigation conveyance and efficiency, and leasing or purchasing water rights and converting those rights to instream use. The conservation project proposed here will restore up to 1.89 cfs of stream flow. It will satisfy many of the actions recommended in the Recovery Plan and would accelerate the recovery of listed fish species.

#### **1.4.4. Evaluation Criterion D: Water Marketing**

An essential component of this project involves the use of water banking/marketing techniques to reallocate water from one water use to another. Broadly speaking, water banking is a mechanism that facilitates the legal transfer and market exchange of various types of surface, groundwater, and storage entitlements. Banking facilitates the reallocation of water rights to alternate uses. This project will provide new supply and increased reliability of water while promoting conservation, regulatory compliance and reduced transaction costs associated with water transfers.

The proposed project will transact up to 673 AF of water transfers and will involve the as-yet unrealized market for Crooked River water rights. Water users benefitting from this project include increased water reliability for irrigated agriculture and increased environmental flows in the Crooked River. The project will generate new Deschutes River water rights by implementing conservation measures. The conserved water will be marketed to agricultural buyers and Crooked River water rights will be marketed to environmental buyers. A new water market will be created to meet one of the Deschutes Basin's most acute and unmet water needs: environmental flows in the Crooked River. When compared to the few known transactions of Crooked River water rights, the estimated cost savings from coordinated water banking will allow this project to generate water supply for environmental flows at 30-50% of currently observed prices.

The mechanism for water marketing involves a capital project and a suite of water transfers. Once the pipeline project is complete, the conserved water will be allocated by lottery to lands in NUID currently served by the Crooked River. This project will provide an alternate source of water to approximately 35 district accounts, rendering up to 673 AF of their Crooked River surface water rights available for reallocation. The new supply will be transferred instream to restore streamflows in satisfaction of the funding requirements of project donors.

Basin stakeholders have extensive experience moving water between uses and users. Their experiences suggest that existing contract with Reclamation will allow and that Oregon's water laws will facilitate marketing of the conserved water.

#### **1.4.5. Evaluation Criterion E: Other Contributions to Water Supply Sustainability**

This project simultaneously increases the reliability of NUID's water supply, being the junior irrigation district in the basin, while providing water to permanently restore instream flows to both improve water quality and fish habitat for ESA listed mid-Columbia steelhead trout. The broader water management context of the Deschutes Basin is one of overallocated rivers, a recent reintroduction of an Endangered Species Act listed fish, increasing municipal demand for water, and variability in the seniority and reliability of irrigation water rights. In addition, climate change forecasts estimate reduced snowpack and seasonal water availability. The partners in the Deschutes Basin have been working proactively to create a water management plan that identifies and implements a suite of projects that meet multiple demands and avoids potential water conflict. This project, as part of the larger North Unit Water Supply Initiative exemplifies the type of project that a broader basin-wide plan is being developed to support, piloting inter-district transactions, and breaking open a new set of opportunities in the basin that capitalize on the strengths/limitations of individual irrigation districts to meet all needs.

Collaborative efforts in the basin gained momentum when the Deschutes Water Alliance (DWA) was formed in 2004 by the Deschutes Basin Board of Control, the Deschutes River Conservancy, the Confederated Tribes of the Warm Springs Reservation, and the Central Oregon Cities Organization, with assistance from a Reclamation 2025 Challenge Grant, to plan for long term water resource management in the Deschutes Basin. The DWA was formed around the belief that it is possible to simultaneously meet new and existing demands for water in the Basin through the cooperation and voluntary participation of the key water suppliers and users in the basin.

The mission of the DWA contains the following three elements:

- Move stream flows toward a more natural hydrograph while securing and maintaining improved instream flows and water quality to support fish and wildlife
- Secure and maintain a reliable and affordable supply of water to sustain agriculture
- Secure a safe, affordable, and high quality water supply for urban communities

The DWA has been expanded to include all stakeholders in the basin and is working towards a long-term water management plan. It has become clear that instream flow needs cannot be fully met in the basin unless the needs of water-short irrigation districts are also addressed. While other Deschutes Basin irrigation districts have completed conservation projects and utilized

Oregon's Conserved Water Statute to put water instream, North Unit, as the junior user, has had the challenge of seeking opportunities to firm up supply while benefiting the rivers. Prior to 2008, NUID's contract with Reclamation preventing them from moving conserved water instream. Changes in their contract with Reclamation in 2008 now allow them to move conserved water instream. By increasing the reliability of water and reducing NUID's energy costs while demonstrably restoring instream flows, the project serves as a model to promote and encourage the collaboration necessary to meet broader DWA goals for the basin. Projects like this, as part of the North Unit Water Supply Initiative, will increase the district's ability to support and participate in increasingly creative projects to restore streamflow. The project, and other projects associated with the North Unit Water Supply Initiative, has the potential to build cooperation and reduce the potential for conflicts that interrupt water supplies.

As discussed above, this project integrates water and energy conservation. Deschutes River water saved by NUID piping projects replaces Crooked River water rights, allowing the Crooked River rights to be marketed for permanent instream use, obviating the need to pump that water for irrigation. The annual pumping costs on the Crooked River Pumping Plant average approximately 15% of NUID's annual operating budget, and create a significant burden to efficient operations.

Irrigation districts and water conservation partners in the Deschutes Basin are actively looking to integrate water conservation projects with reduced energy demand and hydropower generation. This project will provide a strong example of the feasibility and multiple benefits of such projects.

#### **1.4.6. Evaluation Criterion F: Implementation and Results**

##### **Subcriterion No. 1—Project Planning**

Studies completed over the last two decades have consistently highlighted conservation opportunities in the North Unit Irrigation District. Reclamation's Upper Deschutes River Basin Water Conservation Study (1997) highlighted losses in the district including losses associated with conveyance through unlined earthen canal and ditches. North Unit Irrigation District's Water Conservation Plan (Draft Jan. 2012) further identified conservation opportunities within the district including Lateral 58-11. The Deschutes Water Alliance, a group of stakeholders focused on collaboratively meeting water needs in the upper Deschutes Basin, completed a series of regional water supply and demand studies in 2006 with support from a Water2025 grant. The Deschutes Water Alliance's Final Report on District Water Efficiency identified water conservation as the greatest opportunity for meeting new agricultural, municipal, and environmental water demands in the upper Deschutes Basin. This project directly aligns with the goals of the Deschutes Water Alliance and the findings of their studies.

Studies completed over the last two decades have consistently highlighted conservation opportunities in NUID including the piping over open delivery systems within NUID. The proposed Lateral 58-11 piping project is identified in NUID's Water Management Conservation Plan, (Draft Jan 2012) and the U.S. Bureau of Reclamation Water 2025 Challenge Grant Action Plan for NUID (Newton Consultants, 2006). Reclamation's Upper Deschutes River Basin Water Conservation Study (1997) highlighted losses in the district, including the Lateral 58.

The Deschutes Water Alliance, a group of stakeholders focused on collaboratively meeting water needs in the upper Deschutes Basin, completed a series of regional water supply and demand studies in 2006 with support from a Water2025 grant. The Deschutes Water Alliance's Final Report on District Water Efficiency identified water conservation as the greatest opportunity for meeting new agricultural, municipal, and environmental water demands in the upper Deschutes Basin. The study identifies piping NUID's open delivery laterals as a source of water to meet new demands. This project directly aligns with the goals of the Deschutes Water Alliance and the findings of their studies.

Once the 58-11 Lateral was determined to have mutually beneficial outcomes, NUID contracted with Black Rock Consulting to analyze Lateral 58-11 hydraulics and produce the project design. The project design was completed and paid for by Oregon Watershed Enhancement Board (State of Oregon Lottery Funds). Kevin L. Crew (Black Rock Consulting), PE, licensed and bonded in the state of Oregon completed the engineering design for this project in October 2010.

Oregon does not have a state water plan. However, piping the 58-11 Lateral meets both North Unit Irrigation District's goals and the goals of a broad coalition of local, state, and federal basin stakeholders. Marketing the water to instream flow buyers such as the Pelton Water Fund, which has invested in Phase 1 of North Unit Water Supply Initiative, meets the need for projects that restore flow in the lower Crooked River. The following assessments and action plans of the following agencies and organizations highlight the need to restore flow in the Crooked River:

- US Bureau of Reclamation, Upper Deschutes River Basin Water Conservation Study (1997)
- Oregon Department of Fish and Wildlife, Crooked River Basin Plan (1996)
- Northwest Power and Conservation Council, Deschutes Subbasin Plan (2004)
- Upper Deschutes River Watershed Council, Upper Deschutes Watershed Assessment (2003)
- Crooked River Watershed Council, Crooked River Watershed Assessment/Action Plan (2003)
- Oregon Department of Agriculture, Upper Deschutes Agricultural Water Quality Management Area Plan (2002)
- Mid- Columbia River Steelhead (*Oncorhynchus mykiss*) Distinct Population Segment Recovery Plan (2009)

## **Subcriterion No. 2—Readiness to Proceed**

### **Project Implementation**

Qualifications of the design Engineer are:

Kevin Crew, Black Rock Consulting; Professional Engineering, licensed and bonded. Kevin Crew is working in Central Oregon as a Professional Engineer and has been for the last 15 years. His engineering experience and knowledge has served Central Oregon's Natural Resource Community by designing many conservation projects that have resulted in beneficial results to the natural resources and landowners.

The design criteria used or proposed and how those criteria take into consideration natural events and conditions:

Total Station GPS field project survey (elevations, stationing, etc.) that was used for detail design, was provided by USDA and NRCS.

NRCS Hydro/Geologist Paul Pedone inspected the site, collected and submitted soil core samples to the Nebraska Soils Technology Lab for analysis and provided recommendations to the design engineer.

The project site was also inspected by US Bureau of Reclamation Archeologist, Chris Horting-Jones to confirm the project/project site would have no adverse affects on historical or cultural resources. It was determined that the project will have no affect on any known cultural resources. SHPO concurrence letter attached. (see Exhibit C)

Black Rock Consulting provided the follow as it relates to project implementation:

Detailed specifications were developed by Black Rock Consulting for all project work (excavation, slope, fill, pipe size, safety measures, re-regulating berm density, etc.)

Developed detailed project drawings using field survey and aerial imagery. Detailed project section and location maps of the project were developed. (see Exhibit D-1 thru D-6)

Detail materials and construction specifications were developed and a detailed project budget

All project development and design was reviewed in detail with and approved by NUID staff.

Black Rock Consulting designed the piped delivery system of Lateral 58-11 (5 mi) and has been the contract inspector for the Lateral 58-9 (4 mi) piping project. The Lateral 58-9 project was recently completed in its entirety with Black Rock Consulting as project oversight. NOTE: All of the above were developed to the detail that NUID requested, based on their many years of project experience for installation of pipelines and management of irrigation water within the district.

**Environmental compliance is complete and it is part of an ongoing Reclamation Project.** Bureau of Reclamation and Natural Resource Conservation Service Archeologists have completed historical evaluation of lateral 58-11. The surveys found no adverse effects to historical sites of significance because none were observed in the field inventory. There are no known archeological sites in the proposed project area.

## Figure 2. NUID Lateral 58-11 Piping Project Schedule-update

Following is a condensed schedule of work for this project:

2. Project Elements	3. Start Date	4. End Date	5. Description
6. Materials Acquisition Lateral 58-11	7. Oct 2012	8. May 2014	9. Materials Acquisition pending Water SMART grant approval
10. Bid Solicitation	11. Aug 2012	12. Oct 2012	13. NUID purchase materials & contractor work implementation
14. Contracting	15. Nov 2012	16. May 2014	17. Project implementation
18. Construction	19. Nov 2012	20. May 2014	21. Design Engineer, Kevin Crew PE
22. Project Inspection	23. Nov 2012	24. May 2014	25. Project Inspection
26. Post Project Implementation Review		June 2014	Post Project Implementation Review

### Readiness Criteria

In addition to the project designs, biological assessments and cultural resource surveys of the canal have already been conducted and are ready to submit to satisfy the federal environmental and historical compliance. No other permits are needed.

### Available & Proven Design Criteria

Black Rock Consulting has the proven experience and design expertise to provide accurate and concise design criteria. NUID has many years of proven pipe installation and has experienced manpower available to proceed with project implementation.

### Subcriterion No. 3—Performance Measures

#### Canal Piping

Water saved through piping the 58-11 Lateral will be documented through inflow/outflow testing using existing measuring techniques upstream and downstream from the proposed piping project. NUID has extensive measurement water records that can be readily used to verify the effectiveness of the project. This project will reduce canal seepage. Post-project monitoring of this lateral will allow NUID to evaluate post-project losses in the lateral. Comparing pre- and post-project losses will allow NUID to quantify the benefits of the canal lining project.

#### Water Markets – Water Marketing

As described earlier, this project will provide an alternate source of Deschutes River water rights for lands in NUID currently served by water pumped from the Crooked River and will restore a corresponding amount of water instream in the Crooked River. The Oregon Water Resources Department operates a stream flow gage downstream from NUID's diversion on the Crooked River. This gage will provide both pre-project and post-project stream flow data, allowing NUID to demonstrate benefits of water marketing to stream flows in the Crooked River. NUID will also track the number of acres that receive conserved water from the Deschutes River as a result of this project, demonstrating success of the agricultural transfers.



### **Energy-Water Nexus – Increasing Energy Efficiency in Water Management**

Energy savings will be documented by comparing pre and post project electricity use records provided by Central Electric Cooperative (CEC) to NUID. CEC provides monthly power bills to NUID that detail the district's electricity usage for that month and assesses a per kilowatt hour fee. NUID maintains a long-term record of these power bills and will use them as a baseline for quantifying actual post-project power savings. NUID will use the same records and methodology to quantify cost savings. Ag producers benefitting from the 58-11 project will be able to produce electricity use records to confirm the effectiveness of the pressurized system. All ag producers on the 58-11 Lateral are supportive of the project and have entered into a Cooperative Agreement lending their support and commitment to the project. Ag producers are working with the NRCS and local Soil and Water Conservation District to facilitate on farm aspects of the project (piping, meter, valves, etc.)

### **Energy-Water Nexus – Increasing Renewable Energy in Water Management**

The district has conducted a hydropower feasibility study at a location near the terminus of the proposed piping project. Initial review of the elevation drop and average flow rates in the canal at this location suggests (based on averaging data) that approximately 494,148 kW of power could be generated at the site by adding a plant to the project pipeline. The addition of a hydropower facility will be considered in future phases of the Lateral 58-11 project

### **Benefits to Endangered Species**

The proposed project will improve habitat conditions for ESA listed Mid-Columbia Steelhead by improving instream flows in the lower Crooked River. As described in 1.4.3 above, this project addresses key limiting factors identified in the Mid-Columbia Steelhead Distinct Population Segment Recovery Plan. Portland General Electric (PGE) and the Confederated Tribes of the Warm Springs Reservation (Tribes) are required as stipulation of their federal license to operate the Pelton Round Butte Hydroelectric Project to monitor native fish populations (Hill and Quesada, 2009) in a portion of the upper Deschutes Basin that includes the lower 28 miles of the Crooked River. This monitoring effort is described in Section 9 of Recovery Strategies and Management Actions Oregon Mid-C Steelhead Recovery Plan and is administered primarily by PGE. NUID will utilize data and reporting by PGE and the Tribes to determine, to the extent possible, the recovery rate of Mid-Columbia Steelhead in the lower Crooked River.

### **1.4.7. Evaluation Criterion G: Connection to Reclamation Project Activities**

1. How is the proposed project connected to Reclamation project activities?

North Unit Irrigation District is a major part of Reclamation's Deschutes River Project. North Unit Irrigation District operations include Wickiup Dam and Reservoir, Haystack Dam and Reservoir, the North Unit Main Canal, and all project related irrigation delivery facilities. These facilities are all part of Reclamation's Deschutes project.

2. Does the applicant receive Reclamation project water?

Yes, NUID receives stored water from Wickiup Reservoir. Wickiup Reservoir is part of the Deschutes Project.

3. Is the project on Reclamation project lands or involving Reclamation facilities?

Yes.

4. Is the project in the same basin as a Reclamation project or activity?

Yes.

5. Will the proposed work contribute water to a basin where a Reclamation project is located?

Yes. The Deschutes Basin includes both the Deschutes and Crooked River Projects.

### **1.5 References**

BOR. 1997. Upper Deschutes River Basin Water Conservation Study, Special Report, Crook, Deschutes, and Jefferson Counties, Oregon: Bureau of Reclamation.

Carmichael, RW, BJ Taylor. 2010. Conservation and Recovery Plan for Oregon Steelhead Populations in the Middle Columbia River Steelhead Distinct Population Segment. Oregon Department of Fish and Wildlife. February 2010.

CRWC. 2003. Crooked River Watershed Assessment and Action Plan. Prineville, OR: Crooked River Watershed Council.

DEQ. 2002. 2002 303(d) List Database. Salem, OR: Department of Environmental Quality.

DWA. 2006. Deschutes Water Alliance Final Report. Bend, OR: Deschutes Water Alliance.

Gannett, M.W., Lite, K.E., Morgan, D.S. and C.A. Collins. 2001. Ground-Water Hydrology of the Upper Deschutes Basin, Oregon. Water-Resources Investigations Report 00-4162. Portland, OR: USGS.

Hill M, Quesada C. 2009. Native Fish Monitoring: Biological Component 2009 Annual Report and 2010 Work Plan. Portland General Electric Company. Portland, Oregon.

NFWF. 2007. Adaptive Management for ESA-Listed Salmon and Steelhead Recovery: Decision Framework and Monitoring Guidance [http://www.nwr.noaa.gov/SalmonRecovery-Planning/ESA-Recovery-Plans/upload/Adaptive\\_Mngmnt.pdf](http://www.nwr.noaa.gov/SalmonRecovery-Planning/ESA-Recovery-Plans/upload/Adaptive_Mngmnt.pdf).

NMFS. 2009. Mid- Columbia River Steelhead (*Oncorhynchus mykiss*) Distinct Population Segment Recovery Plan. Federal Register /Vol. 74, No. 188 /Wednesday, September 30, 2009

NUID. 2003. North Unit Irrigation District 5-Year Update: Water Management and Conservation Plan. Madras, Oregon.

NPCC. 2004. Deshutes Subbasin Plan. Portland, OR: Northwest Power and Conservation Council.

ODFW. 1996. Crooked River Basin Plan. Prineville, OR: Oregon Department of Fish and Wildlife.

## **2. Environmental Compliance**

- (1) Will the project impact the surrounding environment (i.e., soil [dust], air, water [quality and quantity], animal habitat, etc.)?

This project will have minimal impacts on the surrounding environment. All work will occur within existing irrigation canals and the project sites will be accessed using existing access roads. Earth disturbing work, where required, will occur within existing irrigation canals.

- (2) Are you aware of any species listed or proposed to be listed as a Federal endangered or threatened species, or designated Critical Habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

No federally endangered or threatened species are known to exist in the project area. No designated Critical Habitat exists in the project area. The project will ultimately restore stream flow to the lower Crooked River, improving conditions for ESA listed steelhead trout. The lower Crooked River does not contain any designated Critical Habitat.

- (3) Are there wetlands or other surface waters inside the project boundaries that potentially fall under Federal Clean Water Act jurisdiction as "waters of the United States?" If so, please describe and estimate any impacts the project may have.

No wetlands or other surface waters that could fall under Clean Water Act jurisdiction exist in the project area. The project will ultimately reduce irrigation diversions from the Crooked River, likely improving water quality in the river.

- (4) When was the water delivery system constructed?

On July 21, 1938 construction began on the North Unit project. World War II halted construction, but water was delivered to 17,000 acres during 1946 and 1947 and to all of the 50,000 acres by the spring of 1949. Haystack Reservoir was constructed in 1956-57 to regulate the delivery of irrigation water to the waterusers on the north end of the project.

- (5) Will the project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

This project will modify features of the 58-11 Lateral through conversion of open ditch delivery to covered pipe irrigation delivery system. The 58-11 Lateral is at or near the northernmost area of the district surmising the lateral was constructed in the late 1940's. No extensive alterations or modifications to the features of 58-11 have previously been completed.

- (6) Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places?

Prior conversations with Reclamation have suggested that the entire set of district facilities may be eligible for listing on the National Register of Historic Places. NUID is a working irrigation district and their facilities require maintenance and upgrades to properly function. This project does not represent an adverse affect to historic conditions in the district or within the project area.

- (7) Are there any known archeological sites in the proposed project area?

NUID is not aware of any known archeological sites in the proposed project area.

- (8) Will the project have a disproportionately high and adverse effect on low income or minority populations?

The project will not have a disproportionally high and adverse effect on low income or minority populations.

- (9) Will the project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

This project will not limit access to and ceremonial use of Indian sacred sites. NUID does not expect this project to negatively affect tribal lands.

- (10) Will the project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

This project will not contribute to the spread of noxious weeds or non-native invasive species. Piping an open irrigation canal will limit invasive and non-native plant habitat along the canal, reducing the potential for invasive and non-native plant growth in the project area.

### **3. Required Permits or Approvals**

#### **3.1. Federal Permitting**

The significant federal approvals of National Environmental Policy Act (NEPA), SHPO compliance and archeological surveys have been completed for the total project. This project includes piping of two laterals in the area and the federal approvals were completed at the beginning of these projects, which started three years ago. The Bureau of Reclamation issued a Categorical Exclusion for the canal piping projects in this area.

### **3.2. State Permitting**

No state permits are required

### **3.3. Local Permitting**

No local permits are required.

## **4. Funding Plan and Letters of Commitment**

### **4.1. Cost-Share Requirements**

This project will leverage \$942,982 of federal investments against \$653,103 of non-federal investments to provide the maximum benefits to all funding partners. NUID will provide \$327,361 of match funding through in-kind staff resources supported by district assessments (see Exhibit H). NUID expects that restoration funders, including the Oregon Watershed Enhancement Board and the Pelton Fund, will invest in this project to fully fund it. OWEB and Pelton Fund have been significant supporters of the North Unit Water Supply Initiative and anticipate continued support moving forward. District landowners served by this section of the pipeline will also contribute to the cost of the delivery structure to their property. A cooperative agreement was developed between the Jefferson County Soil & Water Conservation District, North Unit Irrigation District and the landowners. (see Exhibit I).

### **4.2. Pre-Project Costs**

NUID anticipates that this project, as funded by Reclamation, will start in July 2012. Initial survey work, pipeline design and feasibility studies have been completed, so there won't be any pre-project costs.

### **4.3. Funding Partners**

NUID expects to receive non-federal grant funding from the Oregon Watershed Enhancement Board and the Pelton Fund.

The Oregon Watershed Enhancement Board invests in watershed restoration across Oregon. They have a strong history of investing in the Deschutes Basin and have already invested over \$8 million in water conservation projects. OWEB has indicated their interest in funding additional water conservation in the Deschutes Basin and have invited applicants to submit this project for non-federal grant funding. In 2011 OWEB committed \$1 million to the North Unit Water Supply Initiative.

The Pelton Fund is a mitigation fund established as part of a 2005 FERC relicensing process for the Pelton Round Butte hydroelectric project on the Deschutes River. The Pelton Fund has invested approximately \$5 million in stream flow and habitat restoration along the Deschutes River and its tributaries. In 2011 the Pelton Fund committed \$1 million to the North Unit Water Supply Initiative. NUID anticipates applying for and receiving additional funds from this source to assist in funding this project.

### **4.4. Other Federal Funds**

No federal funds have been requested or received from other sources.

#### 4.5. Pending Funding Requests

As described above, NUID and its partners will request additional grant funding from the Oregon Watershed Enhancement Board the Pelton Fund. NUID and its partners have a strong working relationship with these funders and anticipate receiving funding. This project may be delayed pending additional financing if these funders do not fully invest in the project.

#### 4.6. Funding Summary

Table 1. Summary of non-federal and federal funding sources. update

Funding Sources	Funding Amount
Non-Federal Entities	
1. North Unit Irrigation District*	\$327,361.50
2. Oregon Watershed Enhancement Board	\$495,575.00
3. Pelton Fund	\$100,000.00
4. Landowners	\$40,228.50
5. Jefferson County Soil & Water Cons Dist	\$14,500.00
6. Black Rock Consulting	\$2,800.00
Non-Federal Subtotal	\$980,465.00
Requested Reclamation Funding	\$942,982.50
Total Project Funding	\$1,923,447.50
*indicates in-kind contributions	

#### 5. Letters of Project Support

Letters of support have been received from the following organizations (see Exhibit E & E-1)

- USDA – National Resource Conservation Service
- Jefferson County Soil and Water Conservation District
- Middle Deschutes Watershed Council
- Oregon Department of Fish & Wildlife
- Oregon Department of Agriculture
- Oregon Watershed Enhancement Board
- Deschutes River Conservancy

#### 6. Official Resolution

The North Unit Irrigation District approved this project in 2011, so attached is the resolution that was approved. (see Exhibit F)

#### 7. Budget Narrative

*Salaries and Wages:* In-kind contributions from the North Unit Irrigation District will be contributed from assessments in district operations for the equipment and labor used for installing the pipeline. The price per hour set for district employees was based on their current wage and benefits as of January 1, 2012. Hours estimated were based on previous pipeline installations conducted by the district.

*Administrative expenses:* District Manager, Mike Britton will manage the project for the district. The Assistant Manager, Kirk Holcomb and Watermaster, Gary Calhoun will manage the day-to-day operations. The Office Manager, Vicki McKelvy and Water Records Clerk, Sue Levitt will complete the necessary paperwork. An estimate of hourly time is listed in the budget breakdown with an hourly rate based on current wages.

*Fringe benefits:* All hourly wages for the project include fringe benefits which were calculated for each employee and include taxes, health benefits, housing, retirement, etc. These costs are different based on individual employee benefits. (see Exhibit G)

*Travel:* The project is located 11 miles from district headquarters. Travel will include mileage on pickups to get back and forth to the jobsite. Employees travel time is included in the total labor hours.

*Equipment:* Equipment to install pipe, build fittings, pour concrete, seed ground and project clean up will be provided by the district. District equipment to be used will include truck and lowboy to haul equipment to and from the project. The NUID owned and operated cat, excavators, backhoes, dump trucks, grader, laser, etc. will be used in the project. NUID welder will be used to weld metal on the farm deliveries. The price for equipment owned by the district is the hourly operating costs based on the Army Corp of Engineers equipment rates.

*Materials and Supplies:* The purchase of 6,455 feet of 48" HDPE dr 32, 2950 feet of 42" HDPE dr 32.5 and 2080 feet of 42" HDPE dr 26. Fittings to be purchased are a 42" butterfly valve and 4 air and vacuum valves, HDPE fittings for elbows and on farm deliveries that include saddles and metal pipe for 12 deliveries. Concrete for thrust blocks and seeding for ground above the buried pipeline.

*Other in-kind:* In-kind contributions from Jefferson County Soil and Water Conservation will be provided for support & design of the project. The rates for this work were provided from the agencies providing the support. Technical, grant writing, administration, engineering and coordination support will be provided by Jan Roofener, Debbe Chadwick and Kevin Crew.

*Contractual:* NUID will go out to bid to hire a contractor to supply a welding machine and to weld the HDPE pipe. Jefferson County Public Works employees will contract with NUID to construct the road crossings needed to install the pipe under the County roads. Costs for processing the water right transfer and instream water right transfers. These costs include legal fees for the conserved water application, lot book reports on property, digital mapping to GeoSpatial Solutions who maintain the district's digital mapping system and fees to the Water Resources Department for the water right applications. See explanation below for the water right process.

#### *Water Rights Process:*

##### *Conserved Water Agreement, Application, and Administrative Process*

NUID will work with the Deschutes River Conservancy to coordinate with stakeholders and shepherd the conserved water application through the state's administrative process. The Deschutes River Conservancy has extensive experience with this process and, as a non-profit

organization, offers competitive rates. State administrative fees are based on the number of water rights and rate of water rights to be conserved. These applications are critical to the water banking/marketing components of this project.

*Instream Transfer Agreement, Application, and Administrative Process*

NUID will work with the Deschutes River Conservancy to develop instream transfer agreements and applications for this project. They will coordinate with stakeholders and shepherd the instream transfer application through the state's administrative process. The Deschutes River Conservancy has extensive experience with this process and, as a non-profit organization, offer competitive rates. Each taxlot associated with the water rights to be transferred needs a map and title report and these costs appear in the budget estimates. State administrative fees are based on the number and rate of water rights to be transferred instream. This work is critical to the water banking/marketing components of this process.

***Environmental and Regulatory Compliance Costs:*** There are no costs in the budget for environmental and regulatory compliance costs, because this was completed in previous years.

***Reporting Costs:*** District staff will be responsible for the reports on the status of the project as per the grant guidelines. The hours spent on reporting are included in the in-kind hours reported in the budget. The office manager will prepare the financial reports and the manager will provide the progress reports.

***Other Costs:*** None

***Indirect Costs:*** None

***Contingency Costs:*** None

***Total Cost:*** \$1,923,447.50

## **8. Detailed Project Budget**

Please refer to the attached detailed project budget accompanying this application. (see Exhibit H)



Exhibit A

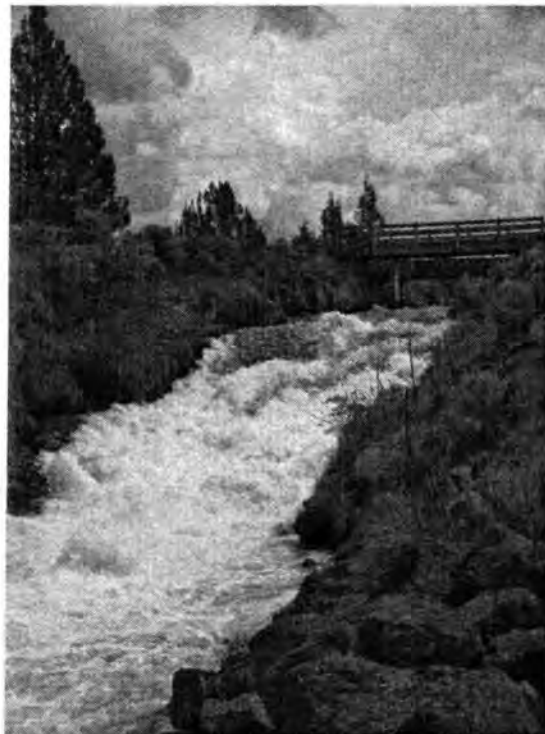
### North Unit Irrigation District - Crooked River Pump kWh usage

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FEASIBILITY REPORT  
to  
NORTH UNIT IRRIGATION DISTRICT  
August, 2009



**FEASIBILITY STUDY ON FIVE POTENTIAL HYDROELECTRIC POWER  
GENERATION LOCATIONS IN THE NORTH UNIT IRRIGATION DISTRICT**



**Prepared by:**

**Kevin L. Crew, P.E., Principal**

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- G. Penstock Sizing, Length, and Net Head Development
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## I. EXECUTIVE SUMMARY

Each of the five projects were evaluated similarly. Gross and net head were developed either based upon field survey data or based upon lateral project design information (58-9, 58-11). Flow information was developed using District measurements and/or Stage Gauge data with the exception of the 58-9 lateral that was developed based upon pre-existing design information, expected peak flow rates, and interpolation from 58-11 data. Grant and other funding source information for each project was included based upon current knowledge of commonly accessed programs and funding sources for Central Oregon hydropower projects. Utility interconnect information was based upon field locations of nearest facilities and current understanding of utility interconnect policies.

Once the power generation estimates were developed for each site, expected utility rates were defined and a table of expected revenue over the next 14 years was developed. Next, a cost estimate range was developed proving a low to high cost range for each project. Significant cost variability exists in the marketplace for turbine and generator systems. Additionally, utility interconnect costs have been found to range significantly.

Lastly, the project revenues and costs were compared based upon first year benefit v. cost of revenue versus amortized loan and simple payback periods. The final ranking and results for the various projects are as follows with "Low" indicating low end of cost range and "High" indicating high end of cost range:

**North Unit Irrigation District**  
**Feasibility Level**  
**Ranking of Five Potential Hydropower Production sites**  
**Black Rock Consulting**  
**August, 2009**

Project Location	Rank	BC/NG Low	High	BC/WG Low	High	SP/NG Low	High	SP/WG Low	High
Haystack Reservoir	1	0.83	0.45	1.40	0.71	12	23	8	14
58-11	2	0.79	0.35	1.18	0.52	14	23	9	22
Brinson Blvd.	3	0.59	0.33	1.02	0.54	17	30	10	18
58-9	4	0.50	0.21	0.75	0.31	22	55	15	37
Smith Rock Drop	5	0.27	0.18	0.47	0.27	26	60	18	36

BC/NG=Benefit v. Cost with No Grant  
BC/WG=Benefit v. Cost with Grants  
SP/NG=Simple Payback Period with No Grant  
Sp/WG=Simple Payback Period with Grants

It should be noted that soft costs such as the cost of financing has not been included in this study or cost analysis as such costs are very project specific and unknown at the time of this study.

Based upon the above results, the District may choose to move forward with the Haystack Reservoir project, the Brinson Blvd. Project and the 58-11 lateral project, however the 58-9 and Smith Rock Drop projects do not appear to be financially attractive given the long payback periods estimated.

It is recommended that any project further considered by the District for action be conceptually designed and then re-costed to insure that the project continues to be viable once more project detail and field information is gathered and incorporated.

## II. BACKGROUND

The intent of this Feasibility Report is to evaluate and present the technical, financial, and permitting feasibility of 5 potential hydroelectric power generation sites in the North Unit Irrigation District, Madras, Oregon. The sites included in this study are identified as:

- Brinson Boulevard
- Smith Rock Drop
- Haystack Reservoir
- 58-11 Lateral
- 58-9 Lateral

These sites are generally located as indicated on Figure 1, below.

Black Rock Consulting of Bend, Oregon was authorized by agreement (dated June 10, 2009) with the North Unit Irrigation District to perform these services. Funding for the Study is from North Unit Irrigation District funds and grant funds from the Oregon Department of Energy.

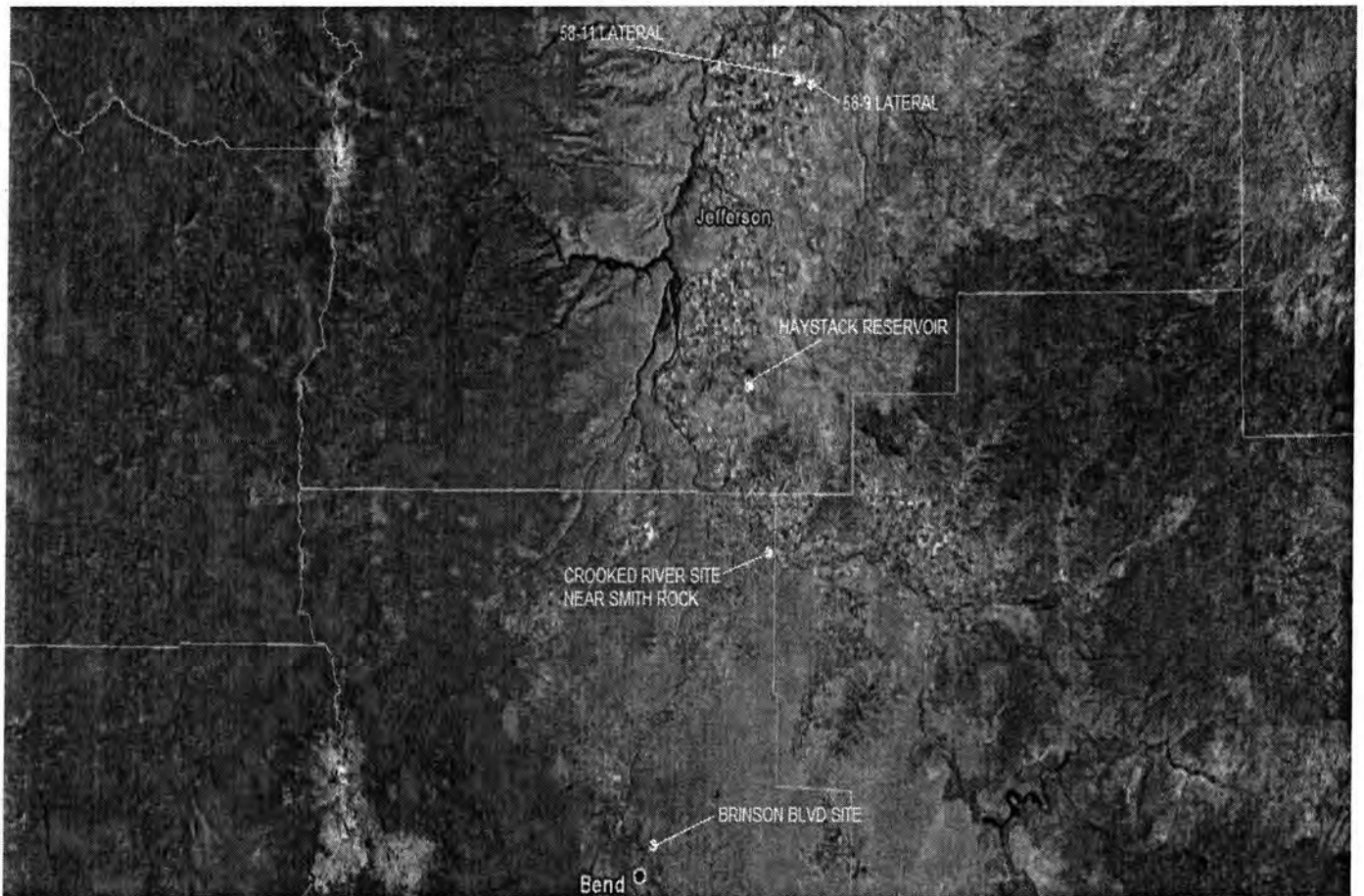
The primary objectives of this Feasibility Study and associated data development were as follows:

- 1) Review any available historical project information provided by NUID.
- 2) Establish project limits based upon canal specifics (elevation differential, existing houses or structures in vicinity, location of existing utility facilities, etc.) for each project site.
- 3) Develop a feasibility-level gross head assessment for each site.
- 4) Develop an aerial site plan (Google Earth aerials) for each site.
- 5) Research and verify probable annual average flow rates (minimum/average/peak) at each site. Data to be gathered from NUID offices.
- 6) Identify permits and agreements that must be completed with the US Bureau of Reclamation, Oregon Water Resources Department, and Interconnect Utility
- 7) Size probable penstock pipe size and material for each site.
- 8) Evaluate project head-loss for each site and develop estimated net head at the turbine for each site.
- 9) Size a feasibility level turbine and generator for each site.
- 10) Request equipment cost estimates from reputable manufacturers.
- 11) Evaluate financing options for the facilities.
- 12) Develop feasibility level cost estimates for each site.
- 13) Develop feasibility level energy production estimates for each site.
- 14) Develop revenue expectations given a typical power purchase agreement contract.
- 15) Develop benefit/cost comparisons for each site.
- 16) Compile the above information for the five sites and providing recommendations for each site.



### III. GENERAL PROJECT LOCATIONS

The five projects are located throughout the North Unit Irrigation District. The following aerial exhibit provides the general locations of the five sites.



## VII. 58-11 LATERAL SITE

### A. Historical Information Review

There was no historical information provided for this project.

### B. Aerial Site Plan

As indicated on Figure 4 below, the 58-11 site is located north of Madras Oregon approximately  $\frac{3}{4}$  mile southwest of the intersection of NE Rex Drive and NE McFarland Drive.

The 58-11 hydropower plant would generate power from the proposed 58-11 lateral pipeline currently under design .

The site is located in a rural farming area with no structures or houses immediately adjacent to the site.



Figure 4: 58-11 Site

### C. Profile/Probable Gross Head

Based upon the 30% design documents produced by Black Rock Consulting and the associated hydraulic analysis developed, the gross static head at the site is 128 PSI.

### D. Historical Flow Data

The NUID monitors the flow rates for its many laterals using staff gauge and weir systems. The District has kept flow records for flows passing down the 58-11 lateral including deliveries and carry water

required. For the piped system, the delivery calls are the most important data as those will drive the actual flow rates within the 58-11 system. The following data provides the min/max/ave flow data for the 58-11 lateral and the associated interpolated flow data available at the proposed hydro site given upstream deliveries predicted based upon irrigated acreage. Data is indicated in cubic feet per second.

58-11				58-11 Hydro Site			
2005	Min	Max	Ave	2005	Min	Max	Ave
April	1.9	35.4	19.5		0.5	8.5	4.7
May	2.0	41.9	16.4		0.5	10.1	3.9
June	23.8	49.4	36.8		5.7	11.8	8.8
July	27.4	48.4	36.6		6.6	11.6	8.8
August	25.4	42.4	35.5		6.1	10.2	8.5
Sept	24.8	37.9	31.0		6.0	9.1	7.4
Oct	10.8	26.4	19.5		2.6	6.3	4.7

#### E. Permitting

Expected permitting for the project will include applying for and obtaining:

- 1) Federal Energy Regulatory Commission (FERC) conduit exemption. This site appears eligible for a FERC conduit exemption in that it involves waters already diverted into a delivery system, and that it is a project less than 15MW. Another criteria is that the real property interests for the project have been obtained. Although the ability of the District to pipe the canal has been addressed favorably in Federal court, the real property ownership beneath the powerhouse should be addressed by the District.
- 2) Jefferson County building permit and zoning clearance for the small powerhouse,
- 3) Oregon Water Resources Department issued water right for use of the canal water for hydropower production,
- 4) If Federal funding is involved in the project, the National Environmental Policy Act (NEPA) process must be followed for environmental clearance related to the project,

Depending upon the final design characteristics of the powerhouse and final findings by the District and the USBOR, additional easement and/or fee ownership of the land beneath the powerhouse may be required and a land use approval by Jefferson County may also be required.

Depending upon the funding sources involved in the project, other necessary processing may include Oregon Department of Energy bond/loan application, ODOE Business Energy Tax Credit application, Oregon Watershed Enhancement Board, Deschutes River Conservancy, ARRA or other funding requirements.

Interconnection with a utility requires an agreement for power purchase as well as an agreement for interconnection. The power purchase agreement will provide guidance on the term and rate for power purchase. The interconnection agreement will provide the technical terms and costs for the interconnection from the proposed plant into the utility grid.

In the case of this project, the nearest powerlines are owned by the Central Electric Cooperative. There are no known reasons at the time of this study that a power purchase agreement and an interconnect agreement may not be obtained. It should be noted that for the purposes of this report the current published PacifiCorp power purchase rates (Schedule 37 peak/off-peak) will be used to develop revenue estimates for the project. Other rates may be negotiated with CEC. Such negotiations are outside of the scope of this study. These rates used are subject to change. In fact, an adjustment to these rates is already under consideration and may be adopted after August, 2009. Additionally, for the purposes of this report, an estimated interconnect cost has been developed based upon recent experience in Central Oregon. It should be noted that the cost of interconnect is subject to the final utility requirements and these may not be obtained until a facility interconnect study is requested and funded and the cost of interconnect may vary significantly from what has been estimated herein.

#### F. Penstock Sizing, Length, and Net Head Development

The penstock is the proposed pipeline under design to pipe the entire 58-11 lateral. Based upon the 30% design work performed by Black Rock Consulting, the expected net head at the powerhouse location under full lateral flow conditions is 247-FT (107 PSI).

#### G. Turbine and Generator

Although a francis type or pelton type turbine would work at the site, such custom turbine systems would be the most costly. The most viable cost alternative is a Cornell Pump Company turbine system which is a standard centrifugal pump run backwards with a generator connected to it. This type of system is approximately ½ the price of the Chinese pelton turbine option.

A Cornell Turbine (6TR2) was sized for this application at a constant set point of 8.8 CFS at 240-Ft of head for feasibility purposes. At 240-FT of head and 8.8 CFS, the rated output would be approximately 145KW.

The undesirable aspect of the Cornell turbine option is that it must run along a set operating curve. To run at a higher flow rate, a higher head must be produced. At lower flow rates, lower head must be produced. This is accomplished through an automated throttling valve that is included in the programming logic for the system.

#### H. Energy/Revenue Production Estimate

From the above data, energy production estimates were produced based upon 240-FT of net head. The results were as follows for one sample year (2005).

	2005 kWh
<b>April</b>	<b>34,872</b>
<b>May</b>	<b>47,212</b>
<b>June</b>	<b>103,094</b>

<b>July</b>	<b>106,530</b>
<b>August</b>	<b>102,899</b>
<b>September</b>	<b>86,693</b>
<b>October</b>	<b>12,848</b>

For study purposes, PacifiCorp Schedule 37 published rates have been used to evaluate the potential revenue from the project. Negotiations with CEC will determine the actual final pricing. The following rates are known as avoided cost purchases and they apply to production of 10MW or less. The table below provides the published rates for on-peak and off-peak in cents paid per kilowatt hour. On-peak hours are 16 hours each day of the week except for Sundays. Holidays and Sundays are off-peak. For the period that NUID operates its system, we calculated the composite rate per kilowatt hour as indicated

Year	On Peak	Off Peak	Composite Price ¢/kWh	\$/kWh
2010	7.21	5.59	6.498658	0.06498658
2011	7.16	5.42	6.395966	0.06395966
2012	7.68	5.86	6.880838	0.06880838
2013	7.72	5.86	6.903274	0.06903274
2014	7.95	6.06	7.120101	0.07120101
2015	8.25	6.32	7.402537	0.07402537
2016	8.4	6.44	7.539364	0.07539364
2017	8.55	6.55	7.6718	0.076718
2018	8.69	6.66	7.798627	0.07798627
2019	8.86	6.78	7.946672	0.07946672
2020	9.03	6.91	8.099108	0.08099108
2021	9.01	6.86	8.065935	0.08065935
2022	9.03	6.83	8.06398	0.0806398
2023	9.06	6.82	8.076416	0.08076416

Based upon these 2010 rates and the 2005 energy production data, the maximum predicted power revenue would be approximately \$32,119. However, with the requirement that the turbine curve be followed when operating the Cornell Turbine, the expected revenue would likely be more in the \$25K-\$28K range annually.

#### I. Feasibility Level Cost Estimate for Project

Feasibility Level Cost Estimate						
ITEM	QTY	UNITS	COST/UNIT LOW	COST/UNIT HIGH	SUBTOTAL LOW	SUBTOTAL HIGH
Turb./Gen/Switchgear	1	LS	\$100,000	\$250,000	\$100,000	\$250,000

Install system	1	LS	\$50,000	\$100,000	\$50,000	\$100,000
Building	40	SF	\$500	\$800	\$20,000	\$32,000
Excavation/Sitework	1	LS	\$5,000	\$10,000	\$5,000	\$10,000
Permits/Processing	1	LS	\$10,000	\$50,000	\$10,000	\$50,000
Electrical Service	1	LS	\$5,000	\$15,000	\$5,000	\$15,000
Electrical Interconnect	1	LS	\$100,000	\$200,000	\$100,000	\$200,000
Contingency	15%				\$43,500	\$98,550
Design/Legal/C.M.	10%				\$29,000	\$65,700
				<b>TOTAL</b>	<b>\$362,500</b>	<b>\$821,250</b>

#### J. Financing and/or Grant Options

The Oregon Department of Energy administers the Business Energy Tax Credit Program. For a municipal organization such as NUID, the program follows a pass-through process to allow the District to pass on credits to a private entity with an Oregon tax burden. To facilitate this process, an incentive is credited to the private business utilizing the tax credits. This net grant opportunity to the District is approximately 33% of the project cost.

Green Tag renewable energy credits will be generated by the project. Should Energy Trust funds be used, the Energy Trust will be interested in retaining all or a portion of these credits. Credits are currently worth approximately \$24/KW of generation.

Although water conservation may not be a key element on the project, alternative energy production is a priority of the State and Nation. The United States Bureau of Reclamation, Oregon Watershed Enhancement Board, and Natural Resources Conservation Service should be approached regarding the long term benefits of the project and on-going grants available.

#### K. Benefit vs. Cost of Project

The following table provides a simple cost benefit analysis for year one of the completed project (2010) based upon assuming the full project debt and then assuming BETC and Energy Trust of Oregon participation.

Benefit versus Cost		
	Low	High
Project Cost Without Financial Assistance	\$362,500	\$821,250
Ammortization Given 20 Year Term and 6% Int.	\$31,604	\$71,600
Revenue Year 2010	\$25,000	\$25,000
<b>Benefit/Cost Ratio</b>	<b>0.7910391</b>	<b>0.349162</b>
Probable BETC 33%	\$119,625	\$271,013

Possible ET Participation	\$0	\$0
Net Project Debt.	\$242,875	\$550,238
Ammortization Given 20 Year Term and 6% Int.	\$21,174	\$47,972
<b>Benefit/Cost Ratio</b>	<b>1.1806933</b>	<b>0.5211373</b>

The simple payback for the project ranges from 14 to 32 years without grants depending upon final project cost. The simple payback period for the project ranges from 9 to 22 years with grant funding depending upon final project cost.

Without grant participation, the project does not appear financially viable. Given moderate cost control during design and implementation of the project, the project yields a positive benefit versus cost ratio and an acceptable simple payback period.

## Exhibit D-1



40° ON 20.0 HOPS	= 1,400.0
45° ON 20.0 HOPS	= 1,850.0
45° ON 30.0 HOPS	= 2,000.0
30° ON 30.0 HOPS	= 1,800.0
35° ON 30.0 HOPS	= 1,700.0
20° ON 30.0 HOPS	= 1,400.0
20° ON 25.0 HOPS	= 1,300.0
20° ON 15.0 HOPS	= 1,000.0
20° ON 0.0 HOPS	= 2,000.0

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SHEET 1 - COVER
SHEET 2 - PLAN PROFILE STA.10+00-STA.20+00
SHEET 3 - PLAN PROFILE STA.20+00-STA.100+00
SHEET 4 - PLAN PROFILE STA.100+00-STA.170+00
SHEET 5 - PLAN PROFILE STA.170+00-STA.120+00
SHEET 6 - PLAN PROFILE STA.120+00-STA.150+00
SHEET 7 - PLAN PROFILE STA.150+00-STA.180+00
SHEET 8 - PLAN PROFILE STA.180+00-STA.210+00
SHEET 9 - PLAN PROFILE STA.210+00-STA.240+00
SHEET 10 - PLAN PROFILE STA.240+00-STA.267+00
SHEET 11 - PLAN PROFILE STA.267+00-STA.279+33.48
SHEET 12 - DRAIN POND
SHEET 13 - DETAILS

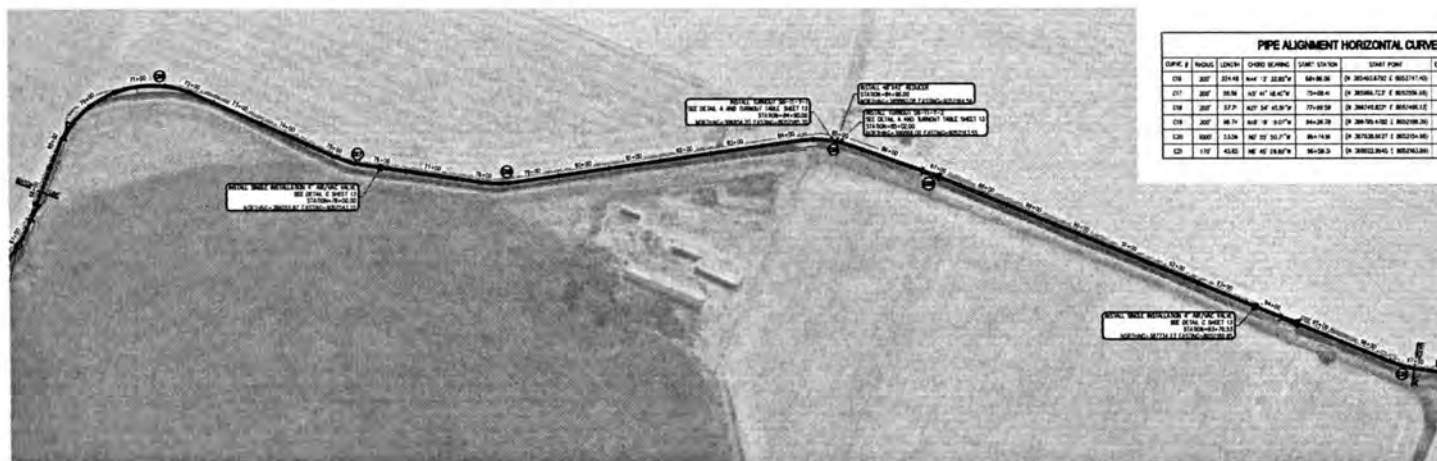
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**BLACK ROCK**  
CONSULTING

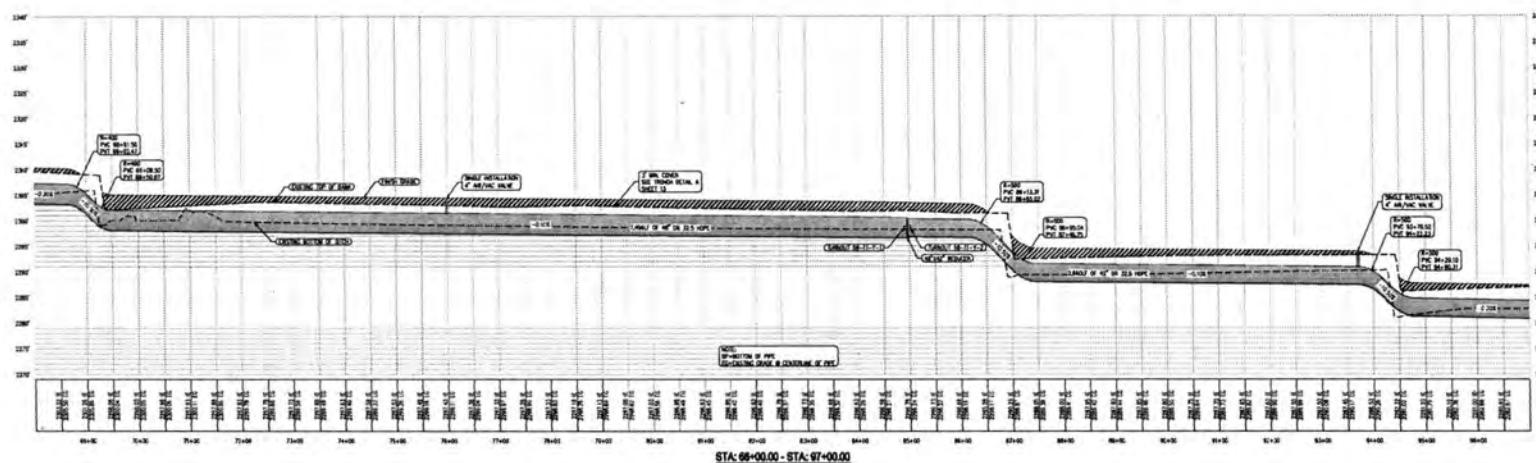
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EXPLOS - IN RECOVERY, 2109





CURVE #	WADSWORTH	CHORD BEARING	START STATION	END STATION	END POINT
1	207	254.48	68+00.00	68+00.00	(N 305°43'47.02" E 802.074' AS)
2	207	30.56	68+00.00	68+00.00	(N 305°43'47.02" E 802.074' AS)
3	207	37.7	68+00.00	68+00.00	(N 305°43'47.02" E 802.074' AS)
4	207	48.74	68+00.00	68+00.00	(N 305°43'47.02" E 802.074' AS)
5	207	55.26	68+00.00	68+00.00	(N 305°43'47.02" E 802.074' AS)
6	207	1.17	68+00.00	68+00.00	(N 305°43'47.02" E 802.074' AS)



NORTH UNIT IRRIGATION DISTRICT  
58-11 PIPING PROJECT

BLACK & ROCK  
CONSULTING ENGINEERS

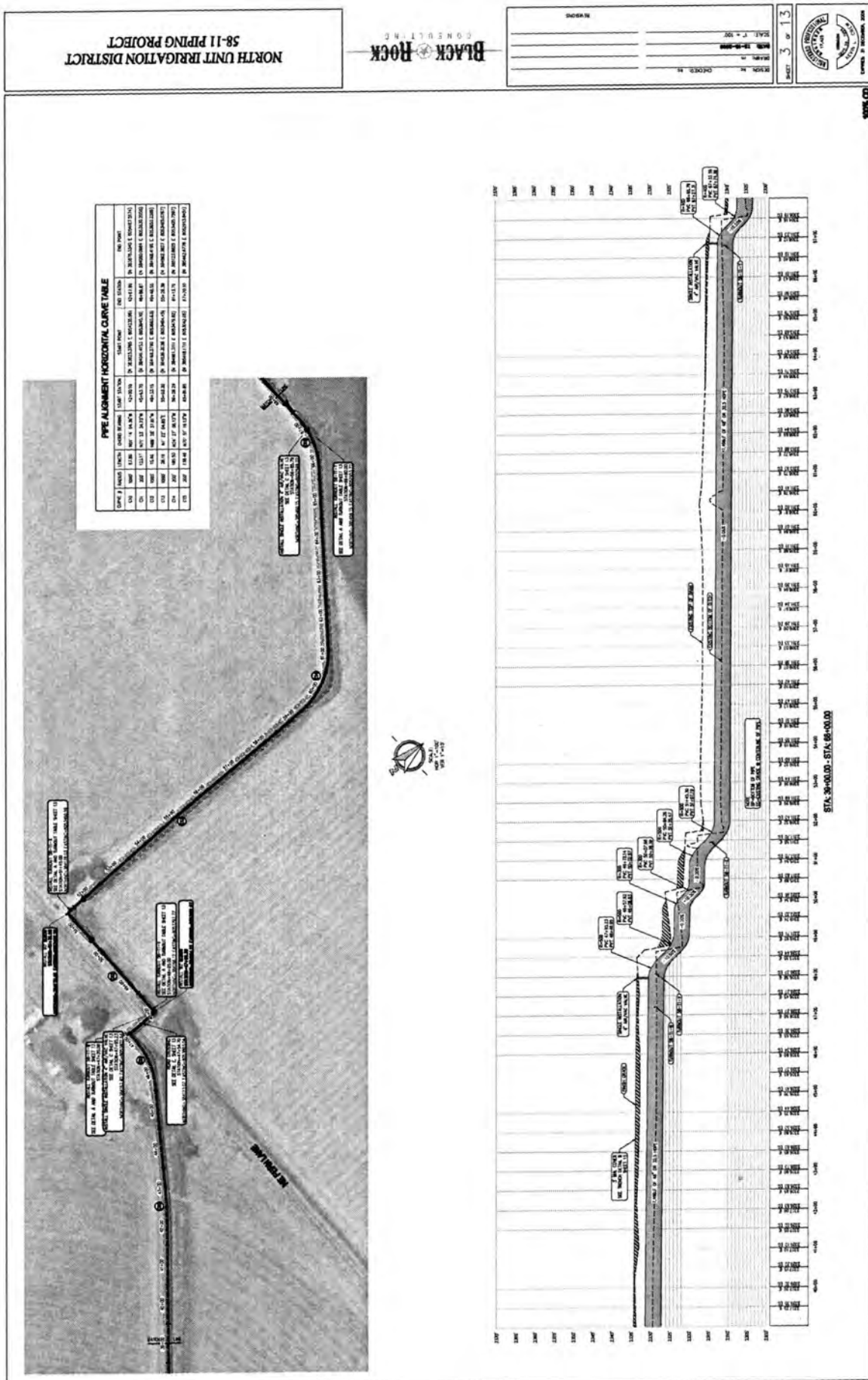
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BY: [Signature]  
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SCALE: 1" = 100'

SHEET 4 OF 13



10/1/2011

Exhibit D-2



NORTH UNIT IRRIGATION DISTRICT  
58-11 PIPING PROJECT

BLACK & ROCK  
CONSULTING

DATE: \_\_\_\_\_

SCALE: 1" = 100'

PROJECT: 58-11 PIPING PROJECT

CLIENT: NORTH UNIT IRRIGATION DISTRICT

DESIGNER: \_\_\_\_\_

CHECKED: \_\_\_\_\_

APPROVED: \_\_\_\_\_

PROJECT: 58-11 PIPING PROJECT

CLIENT: NORTH UNIT IRRIGATION DISTRICT

DESIGNER: \_\_\_\_\_

CHECKED: \_\_\_\_\_

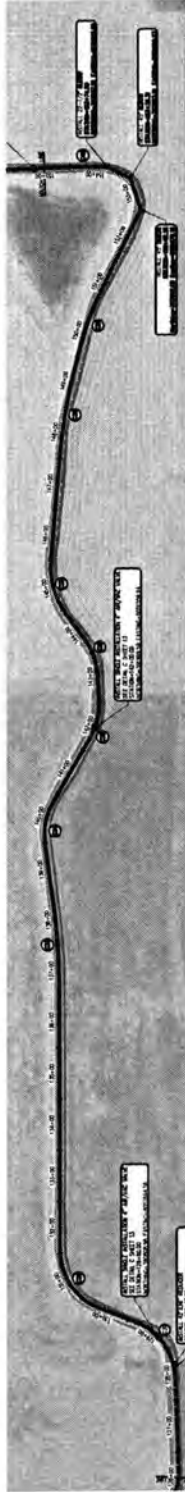
APPROVED: \_\_\_\_\_



NORTH UNIT IRRIGATION DISTRICT  
58-11 PIPING PROJECT

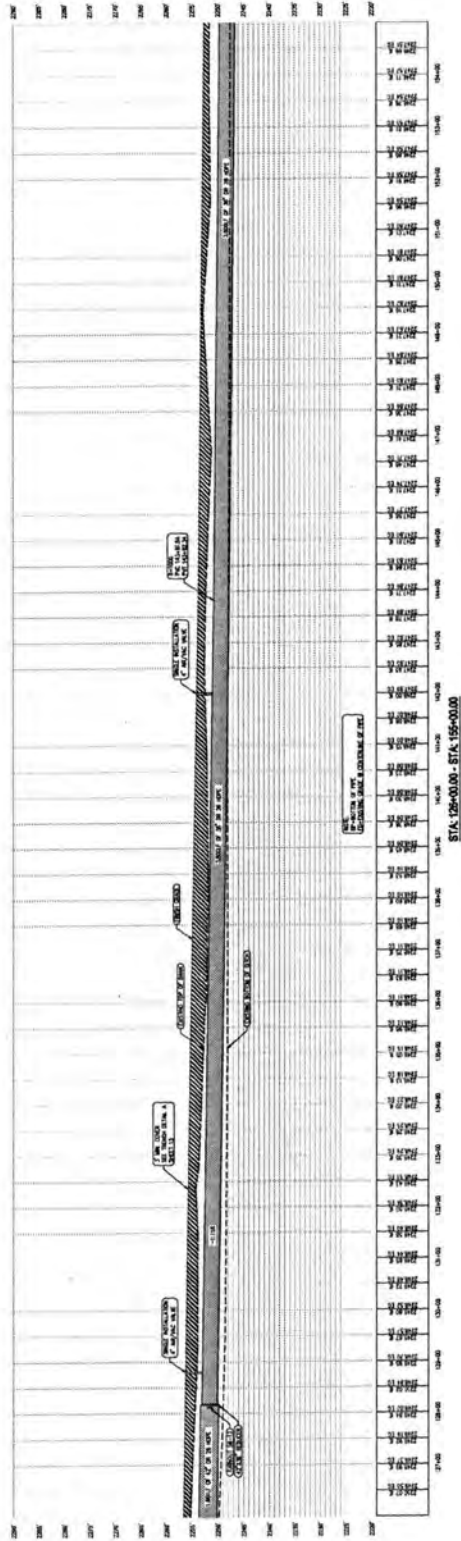
BLACK  
ROCK  
CONSULTING

DATE: 10-10-2020  
SCALE: 1" = 100'  
SHEET: 13  
PROJECT: 58-11 PIPING PROJECT  
DRAWN BY: [blank]  
CHECKED BY: [blank]  
APPROVED BY: [blank]



PIPE ALIGNMENT HORIZONTAL CURVE TABLE

STATION	CHORD BEARING	CHORD DISTANCE	START POINT	END POINT
1+00	100.00	100.00	100.00	100.00
1+05	100.00	100.00	100.00	100.00
1+10	100.00	100.00	100.00	100.00
1+15	100.00	100.00	100.00	100.00
1+20	100.00	100.00	100.00	100.00
1+25	100.00	100.00	100.00	100.00
1+30	100.00	100.00	100.00	100.00
1+35	100.00	100.00	100.00	100.00
1+40	100.00	100.00	100.00	100.00
1+45	100.00	100.00	100.00	100.00
1+50	100.00	100.00	100.00	100.00



United States Department of Agriculture

Exhibit E



Thomas J. Bennett  
District Conservationist

625 SE Salmon Ave. Ste. 4  
Redmond, OR 97756

Phone: (541) 923-4358 ex. 123

Fax: (541) 923-4713

February 2, 2011

To: Mike Britton  
North Unit Irrigation District  
2024 N.W. Beech Street  
Madras, Oregon 97741

Re: Bureau of Reclamation Water Smart Grant for lateral 58-11 piping

As District Conservationist for USDA's Natural Resources Conservation Service in Deschutes and Jefferson counties, I offer my support to your request for assistance to obtain funding to pipe North Unit Irrigation District's lateral 58-11. The improved water use efficiency from the proposed pipeline and on farm efficiencies gained through conservation planning and eventual implementation of on farm system improvements would fit well within what our partnership is trying to do. NRCS in Oregon is making a strong effort to coordinate and focus our resources on priorities identified in a strategic planning process. Working with an identified group of landowners on a project with quantifiable proposed outcomes fits well with that effort. NRCS has recently more formally recognized energy as one of our resource concerns. This project has the potential to conserve energy as well as water.

The previous collaborative effort on lateral 58-9 resulted in seven conservation plans for irrigation efficiency improvements for individual land owners. Some of these projects are now completed.

If this project goes forward, NRCS will help work with the individual landowners to develop conservation plans that include Irrigation Water Management. Those plans could then support applications for financial assistance to the landowners for any needed on farm system improvements that were identified.

If you have any questions, please call me at 923-4358 ext.123

Sincerely,

Thomas J. Bennett  
District Conservationist  
Natural Resource Conservation Service

**JEFFERSON COUNTY SOIL & WATER CONSERVATION DISTRICT**

625 SE Salmon Ave. Suite 6

Redmond, Or. 97756

(541) 923-4358 X 101 Fax: (541) 923-4713

debbe.chadwick@oacd.org



February 4, 2011

To: Bureau of Reclamation

Re: Water Smart 2011 Request for Proposal – North Unit Irrigation District Lateral 58-11

The Jefferson SWCD would like to express support for the Water Smart 2011 Lateral 58-11 piping project through North Unit Irrigation District. The current system was constructed 75 years ago in Central Oregon's volcanic porous soils and looses approximately 40% of the water diverted for irrigation.

Lateral 58-11 drains into Mud Springs and Trout Creek which flow into the Deschutes River. The surface runoff and tailwater contains sediment and nutrients consequently reducing the water quality of Trout Creek. Trout Creek provides critical spawning habitat for summer steelhead and resident redband trout.

Piping the open ditch delivery improves agricultural water management and operation by eliminating evaporation and percolation. Jefferson SWCD continues to work with the NRCS to improve irrigation efficiency on farm for the total 4,500 acres within the irrigation capacity of this project.

Jefferson SWCD received a grant from Oregon Watershed Enhancement Board in the amount of \$49,980.00 for design and engineering for this project ~ which has been completed.

The Jefferson County SWCD supports all partners in the completion of this beneficial project. Since 2006 Jefferson SWCD has contributed approximately \$59,000.00 of in-kind technical assistance to assist North Unit Irrigation District with this project and will commit to continued support into the future.

Warmly,

Debbe Chadwick  
District Manager



From: Heather Williams  
Middle Deschutes Watershed Councils  
625 SE Salmon Ave. Redmond, OR 97756  
Phone: (541) 325-1890  
[Heather.williams@oacd.org](mailto:Heather.williams@oacd.org)

To: Bureau of Reclamation  
Re: Conversion to piped irrigation delivery 58-11

The Middle Deschutes Watershed Councils and 58-11 water users would like to express support for the Lateral 58-11 piping project. The current system was constructed 75 years ago in Central Oregon's volcanic porous soils and loses approximately 40% of the water diverted for irrigation.

Lateral 58-11 drains into Mud Springs and Trout Creek which flows into the Deschutes River. The surface runoff and tailwater contains sediment and nutrients consequently reducing the water quality of Trout Creek. Trout Creek provides critical spawning habitat for summer steelhead and resident rainbow trout.

Piping the open ditch delivery improves agricultural water management and operation by eliminating evaporation and percolation. The approximate amount of water conserved would be 567 acre feet per year. The piping project would be pressurized reducing or eliminating electricity costs for landowners. Local landowners are in favor of this project because of the water and energy savings.

Sincerely,

  
Middle Deschutes Watershed Councils



# MEMORANDUM

## Oregon Department of Fish and Wildlife

**Date:** December 29, 2010  
**To:** Jan Roofner  
**From:** Tom Nelson  
**Subject:** Sediment reduction in Mud Springs Creek

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This letter is to support lateral 58 project proposed by the Jefferson County SWCD. The interest ODFW has in this project is the reduction of fine sediment entering Mud Springs Creek and consequently the lower 2.5 miles of the Trout Creek system. If the proposed project is successful in reducing the amount of fine sediment that enters this stream system it will benefit the ESA listed Mid Columbia River Summer Steelhead.

Increased levels of fine sediment have a detrimental impact on several life history stages for steelhead. Fine sediment can literally suffocate eggs while they are incubating in the streambed. Increased levels fine sediment reduces and shifts the type of aquatic insect production leaving young fish with reduced levels of aquatic insects to prey upon. Additionally the increased levels of fine sediment benefit the intermediate host for Whirling Disease (*Myxobolus cerebralis*) which has been detected in the basin.

The 2009 Summer Steelhead redd counts conducted by ODFW found that there were 49 summer steelhead redds constructed in stream reaches that will be impacted by this project. This level of spawning activity is typical for these stream reaches. This section of stream has a relatively constant stream flow unlike most of the basin above Mud Springs Creek. If this project can significantly reduce the amount of fine sediment that has been entering the system then this area could increase the production of summer steelhead smolts in the affected reaches. It is this reason that ODFW supports this proposed project.

Sincerely,

Tom Nelson  
ODFW  
Trout Creek and 15 Mile Creek  
Habitat Restoration Project Manager

(Trout Creek Project, 1950 NW. Mill St. Madras, OR 97741)





# Oregon

Theodore R. Kulongoski, Governor

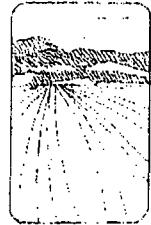
Department of Agriculture

635 Capitol Street NE

Salem, OR 97301-2532

February 10, 2011

Bureau of Reclamation  
Acquisition Operations Group  
Attn: Michelle Maher  
PO Box 25007  
Denver, CO 80225



Dear Ms. Maher:

This letter is in support of Piping of Lateral 58-11: Phase 1, proposed by the North Unit Irrigation District. This phase consists of replacing 8,150 feet of an open canal with HDPE pipe. The completion of all three phases will result in about five piped miles, which will conserve 585 acre feet in canal seepage loss per season. It will also eliminate tailwater that contributes significant amounts of pollutants to Sagebrush and Mud Springs Creeks, which support salmonids.

This project fully supports the Middle Deschutes Agricultural Water Quality Management Area Plan, which promotes "cost-effective agricultural activities that improve and protect water quality".

The lower portion of Trout Creek consists almost solely of Mud Springs water in the summer; any water quality issues in Mud Springs Creek can drastically impair fish habitat in Trout Creek. Currently, excess, warm irrigation water spills out of the bottom of the open lateral and flows into Trout Creek via Mud Springs Creek. This extra water has also been contributing large amounts of sediment to Mud Springs and Trout Creeks due to excessive field erosion. In addition, sediment from the necessary cleaning out of ditches by the North Unit Irrigation District prior to irrigation season ends up in Mud Springs and Trout Creeks. All of these water quality issues are documented in the Agency Plains Water Quality Monitoring Reports from the 2006 and 2007 sampling seasons, written by me and Jan Roofener of the Jefferson SWCD.

The Oregon Department of Agriculture applauds the North Unit Irrigation District, the Jefferson County SWCD, landowners, and all other partners for working together on this complex and beneficial project.

Sincerely,

*Ellen L Hammond*

Ellen Hammond, Regional Water Quality Specialist  
Oregon Department of Agriculture  
475 NE Bellevue Drive, Suite 110  
Bend, OR 97701



# Oregon

John A. Kitzhaber, MD, Governor

## Oregon Watershed Enhancement Board

Central Oregon Regional Office  
6574 NW Larch Drive  
Redmond, Oregon 97756  
(541) 923-7353  
FAX (541) 923-7131  
SL00015@bendbroadband.com

February 4, 2011



Mike Britton, North Unit Irrigation District  
2024 NW Beech  
Madras, Oregon 97741

RE: Bureau of Reclamation Water SMART 2011 RFP

The purpose of this letter is to express our support for piping irrigation Lateral 58-11. The Oregon Watershed Enhancement Board has provided funding for a Technical Assistance grant, in the amount of \$49,980.00 to assist with the design for piping the lateral and constructing a required surge pond where laterals 58-11 and 58-9 split off of the main canal. In addition, OWEB has a current award of \$255,385.00 for the construction of the surge pond.

OWEB provided \$250,000.00 toward the piping of Lateral 58-9. Both of these laterals historically provide irrigation tail-water/carry-water to Mud Springs that joins Trout Creek, an important anadromous spawning and rearing stream for the Deschutes River. Our interest in investing in these projects is to eliminate nutrient loading and the possibility of bacteria contamination into Trout Creek. While not a primary reason for funding these projects, piping these two laterals will improve the efficiency of the irrigation district and its members while requiring less water to meet their irrigation needs. A pressurized delivery system also saves energy.

If we were to receive an application to provide funding support for piping Lateral 58-11, it would be seriously considered. Please do not hesitate to contact me if you have questions or I can be of assistance.

Rick Craiger, OWEB  
Central Oregon Program Representative



**DESCHUTES RIVER  
CONSERVANCY**

February 9, 2011

Mike Britton  
District Manger  
North Unit Irrigation District  
2024 N.W. Beech Street  
Madras, Oregon 97741

RE: Letter of Support for North Unit Irrigation District Lateral 58-11 Piping Project WaterSmart Grant Application

Dear Mike;

The purpose of this letter is to express the Deschutes River Conservancy's (DRC) support for North Unit Irrigation District's (NUID) Lateral 58-11 Piping Project and the associated grant application that is being submitted to the Bureau of Reclamation's WaterSMART Water and Energy Efficiency grant program. The DRC is a 501(c)3 organization with a mission to restore streamflow and water quality in the Deschutes Basin.

The proposed project will directly benefit both streamflow and water quality by reducing seepage loss from Lateral 58-11 and decreasing the amount of nutrient and sediment loading in Mud Springs Creek. In doing so, the project will benefit ESA listed mid-Columbia steelhead trout and resident redband trout, as well as facilitate water quality improvements in Mud Springs and Trout Creeks. Besides the benefits that will accrue to water quality and quantity, the project's energy conservation and renewable energy generation potential hold promise to deliver even greater benefits to the environment and the farmers of NUID.

The proposed Lateral 58-11 project builds on the extensive water conservation and energy efficiency work already undertaken by NUID and reinforces the other collaborative restoration efforts now taking place throughout the Deschutes Basin. Thank you for the opportunity to review your project and please let me know if I can be of assistance as the project moves forward.

Sincerely,

Scott McCaulou  
Program Director



February 1, 2011

Mr. Mike Britton, Manager  
North Unit Irrigation District  
2024 NW Beech Street  
Madras, OR 97741

**SUBJECT: 58-11/58-9 LATERAL RE-REGULATING POND AND PIPING PROJECT**

Dear Mr. Britton:

I would like to extend my support for the Lateral 58-11 re-regulating pond and piping project by the North Unit Irrigation District.

As you know, the NUID irrigators currently receive inadequate water delivery to fully irrigate all 58,000 acres in the District. Piping projects such as the 58-11 project eliminate water losses due to percolation and evaporation, and reduce the need for "carry-water". The result is a more certain supply to the entire District and reduced demand on Wickiup Reservoir. Additionally, main and later piping projects reduce annual maintenance and increase the ability to control flows to the District irrigators.

Another advantage to this project is that whereas the open ditch could only provide gravity flow, the piped system that falls several hundred feet will provide pressurization to deliveries that will reduce or eliminate some pumping costs and reduce the demands on power supply. By eliminating pumping costs in the lower reach of the project area, the landowners may then convert to more efficient irrigation systems such as micro-drip and newer pivot systems. Piping 58-11 lateral will improve the on-farm Irrigation Water Management (IWM).

Yet another advantage to the project is the elimination of spills at the end of the lateral that have historically impacted Mud Springs and Trout Creek and their water quality.

As an engineer and irrigator in the basin, I wholeheartedly support the Lateral 58-11 piping project and re-regulating pond.

Sincerely,

BLACK ROCK CONSULTING

A handwritten signature in dark ink, appearing to read "K. Crew".

Kevin L. Crew, P.E.

20380 Halfway Road Suite #1  
Bend, Oregon 97701  
(541) 480-6257, (866) 691-1513 Fax

# SECURED MATCH FORM

**Project Name:** Open Ditch Conversion to Pipeline Lateral 58-11

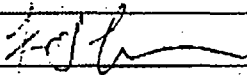
**Applicant:** North Unit Irrigation District

Match Funding Source	Signature of Authorized Representative	Dollar Value	Date
Jefferson County SWCD	<i>Debra Cadwick</i>	\$14,500.00	2/16/2011
Black Rock Consulting		\$2,800.00	
Middle Deschutes Watershed Councils		\$500.00	
Total		\$17,800.00	

# SECURED MATCH FORM

**Project Name:** Open Ditch Conversion to Pipeline Lateral 58-11

**Applicant:** North Unit Irrigation District

Match Funding Source	Signature of Authorized Representative	Dollar Value	Date
Jefferson County SWCD		\$14,500.00	
Black Rock Consulting		\$2,800.00	2/17/11
Middle Deschutes Watershed Councils		\$500.00	
Total		\$17,800.00	

**NORTH UNIT IRRIGATION DISTRICT  
RESOLUTION NO. 2011-03**

**LATERAL 58-11 PIPELINE**

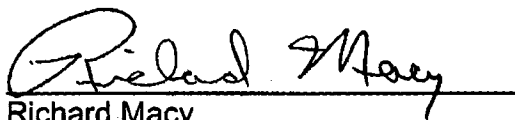
WHEREAS: The proposed project will involve installation of a pipeline to replace a portion of lateral 58-11, which is approximately 2.4 miles in length and serves approximately 1,016 acres. The project will be a cooperative effort between the North Unit Irrigation District, Jefferson County Soil and Water Conservation District, Natural Resources Conservation Service and 8 landowners. The project will provide water and energy conservation; and,

WHEREAS: The irrigation district will realize water savings and the landowners a savings in pumping costs as a result of this project.

NOW THEREFORE, BE IT RESOLVED that the Board of Directors agrees and authorizes that:

1. Michael Britton is the district official with the legal authority to enter into an agreement for financial assistance under the WaterSMART Grant;
2. The Board or governing body has reviewed and supports the proposal submitted;
3. The applicant is capable of providing the amount of funding and/or in-kind contributions, specified in the funding plan; and
4. If selected for a WaterSmart Grant, the applicant will work with Reclamation to meet established deadlines for entering into a cooperative agreement.

DATED: 2-8-11

  
Richard Macy  
Chairman

ATTEST:

  
Michael Britton  
Secretary- Manager